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AUTHOR	Williams, David Brian
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ABSTRACT

Three experiments examined the effects of selected factors of interval size, timbre, loudness, and length of the melodic pattern on children's ability to perceive, the motion of 2- and 3-pitch melodic patterns. Subjects for all experiments were 32 second- and 32 fifth-grade children. The task for each experiment consisted of identifying the motion of unidirectional 2- and 3-pitch melodic patterns which used melodic intervals of varying size. After each pattern, the child made a three-choice button push to indicate whether the music moved up, down, or to the same pitch. Experiment I trained children to focus on the pitch dimension of melodic motion. Experiment II examined the effect of varying the timbre and loudness of the first tone of the pattern. Experiment III examined the effect of increasing the length of the melodic pattern from 2 to 3 tones. The results indicated that errors in identifying melodic motion increased as melodic interval size became smaller. Timbre or loudness variations significantly biased perception of melodic motion in an ascending direction with the smallest melodic interval. No interaction was found between interval size and the variables of task and grades. Fifth graders performed significantly better than second graders. The results also indicated that the varied task was more difficult than the fixed task. (Author/BD)

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Children's Perception of Motion in Unidirectional, Two- and Three-Pitch Melodic Patterns and the Related Effects of Change in Timbre, Loudness, and Duration

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CHILDREN'S PERCEPTION OF MOTION IN UNIDIRECTIONAL, TWO- AND THREE-PITCH MELODIC PATTERNS AND THE RELATED EFFECTS OF CHANGE IN TIMBRE, LOUDNESS, AND DURATION

David Brian Williams

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ABSTRACT

Three experiments examined the selected factors of interval size, timbre, loudness, and length of the melodic pattern of children's ability to perceive the motion of 2- and 3-pitch melodic patterns. Thirty-two second- and 32 fifth-grade children participated in all experiments. The task consisted of identifying the motion of unidirectional, 2- and 3-pitch melodic patterns which used melodic intervals of varying size. After each pattern, the child made a three-choice button push to indicate whether the music moved up, down, or to the same pitch. Experiment I trained children to focus on the pitch dimension of melodic motion. Experiment II examined the effect of varying the timbre and loudness of the first tone of a pattern on children's perceptual focus on pitch. Experiment III examined the effect of increasing the length of the melodic pattern from 2 to 3 tones. Melodic interval size was examined in all experiments and used as a within-group variable. Task (fixed and varied initial tone), duration of the initial-tone and the intertone time (200 and 1500 msecs), and grade (second and fifth) were between-group effects for all experiments. The results indicated that errors in identifying melodic motion increased as melodic interval size became smaller. Timbre or loudness variations significantly biased perception of melodic motion in an ascending direction with the smallest melodic interval. No interaction was found between interval size and the variables of task and grade. Fifth graders performed significantly better than second graders. The varied task was more difficult than the fixed task.

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CHILDREN'S PERCEPTION OF MOTION IN UNIDIRECTIONAL, TWO- AND THREE-PITCH MELODIC PATTERNS AND THE RELATED EFFECTS OF CHANGE IN TIMBRE, LOUDNESS, AND DURATION

David Brian Williams

Identifying the contour of a melody is a task frequently required of children in music instruction. Essential to the performance of this task is the ability to perceive the motion of the melody, the sequential movement of pitch over time. Previous research (Bentley, 1966 & 1973; Duell & Anderson, 1967, Williams, Note 1) suggests that the ability of children to perceive the motion of melody is a function of the size of the melodic interval (the distance in pitch between two tones). As the melodic interval becomes smaller, there is a decrement in performance. Overall ability to identify melodic motion appears to improve with age, although performance remains a function of interval size.

Music is a composite event made up of the psychological elements of sound: pitch, timbre, loudness, and time (Lundin, 1967). A musician can selectively focus his attention on various elements of a music event depending upon the nature of the task. When a child is asked to identify the motion of melody, he is being asked to selectively attend to the motion of pitch and to disregard perceptible changes in timbre, loudness, and duration. Models of attention (Norman, 1969) suggests that the degree to which a child can be expected to selectively attent to pitch motion (relevant information) is dependent upon his cognitive experience with melody tasks. In the absence of sufficient experience, a child may consider relevant that element of sound which is physically dominant (i.e., changes in the frequency, intensity, or harmonic spectrum). A child may well focus on loudness or timbre changes in a melodic event if the degree of perceptible change in those dimensions exceeds that of changes in the pitch dimension.

The first question addressed by the present study was: Given an established perceptual set to focus on the motion of pitch in melodic intervals, will children's perceptual focus be biased by simultaneous variations in timbre and loudness? Research with verbal auditory information has shown a developmental increase in children's ability to focus on relevant information (e.g., Doyle, 1973; Maccoby & Konrad, 1967). It was predicted that, if variations in tibre and loudness do bias perception of melodic motion, this bias would affect younger children to a greater degree.

A second consideration is the effect of time on perception of melodic motion; this includes the duration of a tone, the silent time between tones, and the rate of presentation. Using a melodic motion

identification task with young children, Williams (Note 1) randomly varied across trials the duration of the initial-tone of the music interval and the intertone time. The data showed that young children performed best when the intertone silent time was 2000 msecs in length. This would seem to be an inordinately long time. Data for the duration of the initial-tone and the rate of presentation were inconclusive. It may be that the random presentation of time events across trials only served to confuse children, not permitting the development of any one strategy for coping with time variations.

Questions addressed by the present study were: With time events held constant across trials for a child, will longer intertone durations enhance younger children's perception of melodic motion? To what extent will the duration of the intial tone and the overall rate of presentation affect perception of melodic motion? No predictions were made.

Another question of this study was related to the number of tones in a melodic pattern. Will performance on a melodic motion identification task improve when the number of tones in one-direction melodic patterns are increased? Based on data from experimentation by Williams, Sievers, and Hattwich (1932), it was predicted that performance would improve when one-interval patterns were expanded to two-interval patterns, and that the effect of interval size on performance would be diminished.

In both the Duell and Anderson (1967) and Bentley (1973) research, children's performance on ascending interval motion was lower than performance on descending intervals. The relation of a melodic interval to the singing range of children may explain this variance in performance as a function of melodic direction. A conservative estimate of the singing range of a young child (7-9 years) would be 220 to 523 Hz (cf. Jersild & Bienstock, 1934; Lobbato, Note 2). Bently (1973) and Duell and Anderson (1967) derived their melodic intervals from around a 440 Hz standard. If singing range is a significant factor in pitch discrimination as Zwissler (1972) and Bentley (1966) have indicated, then melodic motion of descending intervals derived from a 440 Hz standard would be easier to identify because the second tone will sound within the estimated singing range. Ascending patterns would lie in the upper extremities of the singing range. For the present study ascending and descending intervals were generated within the estimated singing range and it was predicted that there would be no difference in perception of melodic motion as a function of melodic direction.

The majority of child pitch discrimination studies have used the method of constant stimuli with a fixed standard or initial tone (e.g., Soderquist and Moore, 1970). Duell and Anderson (1967) did vary their initial tone between 390 and 440 Hz in 5 Hz steps. The present research used to stimulus paradigms: The first paradigm had a fixed initial tone located toward the center of the estimated singing range; the second paradigm had a variable initial tone which randomly varied over five discrete semitones from the middle of the singing range. On the fixed

task, processing of the initial tone of an interval is greatly reduced since the first tone is constant. The varied task better approximates a music event in that both tones of the melodic interval vary within a given set. To best perform this task, a child needs to process both tones of the interval. It was predicted that the varied task would be the most difficult for children.

The present study also sought to replicate the interval size effect found in Duell and Anderson (1967), Bentley (1966), and Williams (Note 1). These studies demonstrated that smaller melodic intervals result in greater errors in perception of melodic motion. It was hypothesized that, if in fact, children cannot perceive the motion of small pitch differences, then an analysis of their responses should reveal errors to most frequently be "same" responses.

In sum, the three experiments described in this paper are concerned with investigating the effects of selected factors on second and fifth-grade children's perception of melodic motion with two types of experimental tasks, fixed and varied intial tone. The selective factors were (1) variation of timbre, loudness, and duration; (2) length of the melodic pattern; and (3) size of the melodic interval. Children were asked to listen to a melodic pattern and then identify whether the music moved "up to a different pitch," "down to a different pitch," or "straight across to the same pitch." Response was made by a three-choice button push.

Experiment I trained the child to focus on the pitch dimension of melodic motion. Experiment II examined the effects of melodic interval size, and variation in timbre and loudness on perception of melodic interval motion. Experiment III examined the effect of varying the size of the first interval of two-interval patterns on perception of melodic motion when all tones move in the same direction. Task (fixed and varied initial tone), duration of the initial tone (200 and 1500 msecs) and the intertone silence (200 and 1500 msecs), and grade level were between-group variables. All children in the study participated in all three experiments. Ordering of Experiment II and Experiment III were counterbalanced. Children were randomly assigned to levels of task complexity and initial-tone and intertone duration at the beginning of each experiment.

GENERAL METHODOLOGY

Participants. The children were 32 second and 32 fifth graders from an elementary school in Westminster, California. One entire class was used, then the remainder were selected at random from another class to make 32 children per grade. The mean chronological ages of the children were 7.8 years and 10.8 years for the two grades. The sample is suburban, largely white, middle class. No child was found to have serious hearing deficiencies by a standard audiometry screening. General music instruction at the school consisted of training by a music specialist every other week for one 30-minute period. Fifteen of the fifth graders had one or more years of experience on a musical instrument.

Stimuli. Melodic patterns in the study consisted of two-pitch (one interval) patterns in Experiments I and II, and three-pitch (two intervals) in Experiment III. All tones of a pattern moved in the same direction. Tones were selected from an equal-tempered scale within the estimated singing rage of children (cf. Lobbato, Note 2). Melodic intervals, unison to the major seventh, were derived from the initial tone of a pattern. For the fixed task, the initial tone was constant at 311 Hz (Eb). For the varied task the initial tone was randomly varied across five discrete semitones, C#-D-Eb-E-F (277 to 349 Hz).

The standard timbre (Timbre 1) was a waveform strong in upper harmonics and having a "rich" sound. The alternate timbre (Timbre 2) used in Experiment II was a waveform deficient in upper harmonics and having a "bland" sound. Figure 1 shows the spectra of the timbres as measured at the earphones and averaged over the range, 196 to 466 Hz. The standard loudness was 92 dBA $\pm$2 dB as measured at the earphones and averaged over the range of frequencies used in the study. The alternate loudness for Experiment II was 82 dBA $\pm$2 dB. Both timbres were equated to 92 and 82 dBA with a GR 1565-B sound pressure level meter[1]. The rise and decay time of all tones was 25 msecs.

Instrumentation. Musical tones were produced by a digitally controlled tone generator. This instrument permits the programmed sequencing of a series of melodic tone patterns on digital paper tape (Williams & Hoskin, 1976). Slides were used for visual information and projected on a rear-view screen with a carousel projector. A "listen" visual showed a cartoon character with headphones; a "respond" visual showed three arrows pointing up, straight across, and down. Timing, loudness attenuation, sequencing, and logic control of visual and audio events were performed by Grason-Stadler, Series 1200 equipment. TDH-49 headphones were used.

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[1] Even though the physical intensities of the timbres were equal, there was likely to be some difference in their perceived loudness due to the greater harmonic energy of Timbre 1. No equalization curves are availalable that would allow perceptually equating, for children, the loudness of the two timbres.

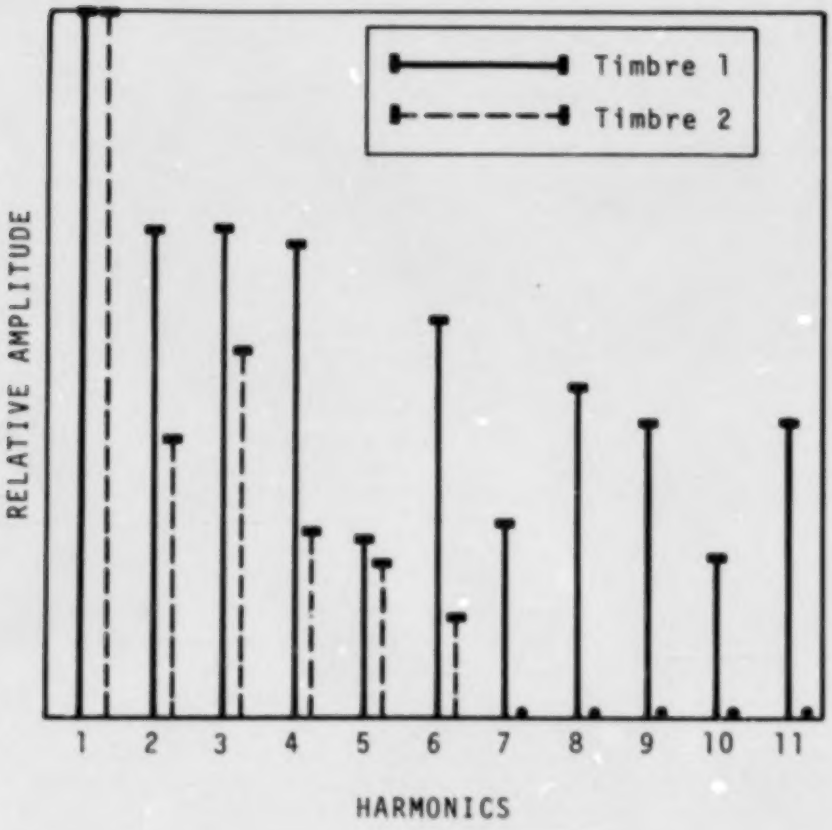

Figure 1. Spectra of the timbres as measured at the earphones and averaged over the range, 196 to 466 Hz.

The equipment was installed in a trailer and set up at the school site. The child sat facing a display unit. Visual materials were presented on the rear-view screen; audio stimuli and instructions were presented binaurally through the headphones. Directly below the screen were three buttons for the child's response. These buttons aligned with the "respond" visual. The experimenter sat behind the child and recorded the response from a lighted display triggered whenever a button was pressed. Figure 2 shows the laboratory setting in the research trailer.

Figure 2. A view of the SWRL Audio Laboratory showing the experimenter monitoring a child listening to stimulus material for the melodic-motion research.

Experiment 1

The purpose of Experiment I was to determine the effects of the study's between-group variables on training children to perform a melodic motion identification task using large melodic intervals. It was assumed that with training on the task, children would acquire a perceptual set for pitch motion as the relevant attribute in identifying melodic motion. Timbre and loudness dimensions were held constant throughout the training; pitch varied across the intervals of a perfect fourth and fifth, major sixth, major seventh, and the unison.

The design was a randomized group with the between-group factors of task (fixed and varied), initial-tone time (200 or 1500 msecs), intertone time (200 or 1500 msecs), and grade (32 second- and 32 fifth-grade children). The 64 children were blocked by grade and then randomly assigned to the remaining conditions. Response was measured by the child's three-choice button push. Each response was confirmed or corrected with verbal feedback.

Stimuli. The stimuli consisted of 36 total presentations of four ascending, four descending, and four unison melodic intervals randomized over three replications.[2] Each trial presented in series: (1) a "listen" visual, (2) two melodic tones, (3) a "respond" visual, then (4) feedback of results. The initial-tone and the intertone time of all melodic intervals for a given child was one of four comibnations of 200 and 1500 msecs. The second tone of the interval was 1000 msecs in length. Timbre 1 and the 92 dBA loudness level were used. Tones of the intervals were determined as previously described.

Procedures. Children were tested individually at the school site and during normal school hours. At the beginning of the session hearing tests were made. Then the child was seated in front of the display unit and shown how to respond by pressing the buttons. A check was made to see if the child could associate the labels up, down, and straight across with the three response arrows displayed on the screen. Following this the experimenter presented a brief instructional sequence with visuals to explain the experimental procedures. The child was asked to tell "how the pitch of the music moved." After the instruction the child proceeded through the 36 trials of melodic intervals; he was given verbal feedback after each response. The session took about ten minutes.

Results

The number of correct responses on the Experiment I training were computed for each child as the average percent correct for three replications of each interval size. To stabilize the variance of the percentages, the data were scaled from 0 to 3.14 with an arcsin transformation (Winer, 1971). Then response scores for each interval size were pooled to obtain a child's mean correct score. Data are reported as a proportion of 3.14.

A 2 (grade) X 2 (task) X 2 (initial-tone time) X 2 (intertone time) analysis of variance was performed on the training scores. The performance of second graders ($\bar{X}$ = .66) in learning to identify the motion of large melodic intervals was significantly lower than that of fifth graders ($\bar{X}$ = .88), F (1, 48) = 32.30, $p<.0001$. Grade level did not significantly interact with performance under any of the other experimental conditions. Children's performance was not significantly better on the fixed task ($\bar{X}$ = .79) where the initial tone was always an Eb, than on the varied task ($\bar{X}$ = .75) where the initial tone randomly varied across five tones.

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[2]Throughout the study, the number of unison intervals were made equal to the number of ascending and descending intervals. This equalized the probability of occurrence for any one interval direction (p = .33).

The duration of the initial tone appeared to alter performance, F (1,48) = 3.71, $p<.06$. Children correctly identified the motion of fewer intervals when the initial tone was 200 msecs in duration ($\bar{X}$ = .81). The amount of silent time between the two tones of an interval had no effect on performance, and the interaction between the duration of the initial-tone and the intertone silence was not significant, Fs (1, 48)<1.0.

There was, however, a significant relationship between the nature of the experimental task and duration of the initial tone of the interval, F (1, 48) = 3.86, $p<.05$. Under the fixed task condition, the mean performance for both the 200 and 1500 msecs initial-tone times was .79. Under the varied task condition, the mean performance was .67 for those children who heard an initial tone of 200 msecs in length and .82 for those who heard an initial tone of 1500 msecs in length. Appendix A contains the average, transformed response across interval type for each child in Experiment I.

Discussion

The purpose of Experiment I was to establish focus on pitch in a melodic motion identification task by training children's response over 36 stimulus presentations with verbal feedback. The data from this experiment demonstrated that with training fifth-grade children are quite successful in learning to identify the motion of large melodic intervals. The high level of performance suggests that, with training, these children exhibit the ability to focus on pitch motion as the relevant dimension in perception of melodic motion. The second graders were moderately successful in learning to identify large interval motion. The second grade data suggest that focus on pitch motion as the relevant attribute in the task was only minimally established.

The outcome of the time effects suggests that when the duration of events in a melody are held constant, the duration of the tone alone is critical in learning to identify melodic motion. When time effects are considered, there was a difference in performance as a function of the task design. Children using the varied task required a 1500 msecs initial-tone duration to successfully identify the melodic motion of an interval. Apparently, a child needs a longer encoding time in the presence of the stimulus event when it is necessary that he process and retain that particular tone in order to perform the task.

Experiment II

This experiment examined the effects of varying melodic interval size, and varying the timbre and loudness of the initial tone of an interval on children's performance in a melodic motion identification task. Compared to Experiment I, this experiment used small two-pitch intervals. The study's four between-group variables were also considered,

i.e., task, initial-tone and intertone time, and grade level. With the training in Experiment I, it was assumed that the children who participated in this experiment had developed a perceptual set for pitch motion as the relevant attribute in identifying melodic motion. It was hypothesized that the timbre and loudness variations in this experiment would bias perception of melodic motion, especially the perception of the second-grade children.

The design was a split-plot with repeated measures. The 64 children were blocked by grade level and then randomly assigned to levels of the three remaining between-group factors. The within-group, repeated measures were interval type with seven levels (descending perfect fourth, minor third, and minor second, unison, and ascending minor second, minor third, and perfect fourth), timbre of the initial tone (Timbre 1 and Timbre 2), and loudness of the initial tone (82 and 92 dBA). All within-group factors were counterbalanced and the order randomized over three replications. Response was measured by the child's three-choice button push, the music moves up, down, or straight across. No feedback of results was given.

Stimuli. The design of each stimulus presentation was similar to Experiment I. Feedback was eliminated. As before, the initial-tone and intertone time for a given child was one of four combinations of 200 and 1500 msecs. The duration of the second tone of an interval was constant at 1000 msecs; the timbre and loudness of the second tone was always Timbre 1 at 92 dBA. The initial tone, however, randomly varied over four combinations of timbre and loudness: Timbre 1 at 92 dBA, Timbre 1 at 82 dBA, Timbre 2 at 92 dBA, and Timbre 2 at 82 dBA. There were 108 stimulus presentations: Nine melodic intervals (3 ascending + 3 descending + unisons) across four combinations of timbre and loudness, each randomly varied over three replications. The 108 trials were presented in two sessions. Tones of the intervals were determined as previously described for both the fixed and varied conditions.

Procedures. Children were tested in this experiment two to three days after either Experiment I or III, depending upon their assigned order. The stimuli were administered in two 10-minute sessions of 54 trials each. Presentation of the two parts of the experiment was counterbalanced. The sessions were separated by two days. At the beginning of each session the child received a brief review of the experimental procedures and performed two practice trials. The child was told to "listen only to how the pitch of the music moves. Other things may be different, but you listen only to the pitch of the music."

Results

The number of correct responses in Experiment II were computed for each child as the average correct for three replications of each experimental condition. The data were scaled from 0 to 3.14 with an arcsin transformation; data reported are shown as a proportion of 3.14. The data from Experiment II are recorded in Appendix B. Preliminary analysis

revealed no differences for the between-group factors of initial-tone and intertone time, nor did these variables interact with others. The data were collapsed over these two factors.

To establish a base line for further data analysis, a 2 (grade) X 2 (task) X 7 (interval type) analysis of variance, with the last factor a repeated measure, was performed on only the 27 items which maintained a constant timbre and loudness, Timbre 1 at 92 dBA. The mean fifth-grade performance in identifying melodic motion of these items ($\bar{X}$ = .79) was significantly greater than the mean second-grade performance ($\bar{X}$ = .59), F (1, 60) = 17.43, $p<.0001$. Performance on the fixed task ($\bar{X}$ = .78) was significantly better than performance on the varied task ($\bar{X}$ = .60), F (1, 60) = 13.25, $p<.001$. The interaction of Grade X Task was nonsignificant, F (1, 60)<1.0. As the repeated measure, the interval type effect was significant, F (6, 360) = 34.08, $p<.001$. Figure 3 shows a W-shaped curve for the fifth- and second-grade performance across interval type for the Timbre 1, 92 dBA items in Experiment II. Interactions of interval type with the between-group effects were nonsignificant. The ends of the curves show the mean performance for the three largest intervals in the Experiment I training. It can be seen that ability to identify melodic motion was comparably reduced from the levels established in Experiment I as the ascending and descending melodic intervals became smaller. A post-hoc F-test revealed no significant difference in performance as a function of interval direction, F (1, 60)<1.0.

To examine all of the timbre and loudness data, a 2 (grade) X 2 (task) X 2 (timbre) X 2 (loudness) X 7 (interval type) analysis of variance was performed with the last three factors as repeated measures. Interactions higher than second order were pooled with appropriate error terms. Mean squares were based on the degrees of freedom. A test of significance was based on the df adjusted by epsilon (ε), a statistic which indicates the degree of heterogeneity of the within-group covariance for any given main effect or interaction (Hopkins & Peckham, Note 3).

Between-group variables. Fifth grade children scored significantly higher ($\bar{X}$ = .76) than second grade children ($\bar{X}$ = .56) when melodic motion identification was examined across repeated measures, F (1, 60) = 29.34, p .0001. Performance on the fixed task was significantly higher ($\bar{X}$ = .72) than performance on the varied task ($\bar{X}$ = .60), F (1, 60) = 9.72, $p<.003$. Further, performance on the two tasks did not significantly vary as a function of grade, F (1, 60)<1.0. The task effect significantly interacted with one within-group combination, Timbre X Loudness X Task, F (1, 54) = 20.84, $p<.0001$. Grade and task effects interacted with the interval type effect, F (4,216) = 3.18, $p<.01$. Inspection of the data associated with these interactions revealed seemingly spurious relationships. Further attempts to explain the relationships on the basis of the variable of interval type produced involved interpretations that did not appear relevant to the questions addressed by this research.

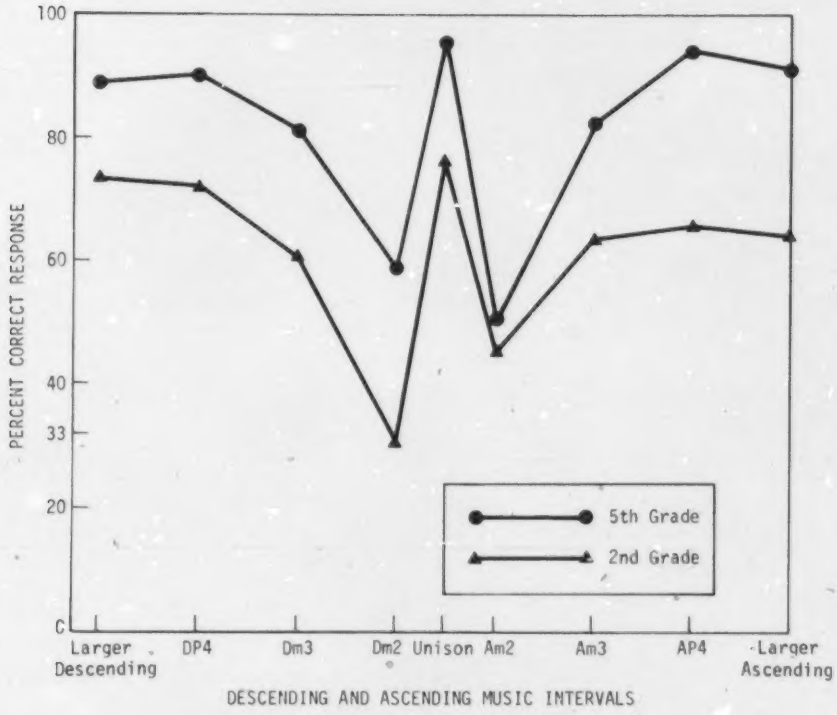

Figure 3. Performance across interval types for second- and fifth-grade children in Experiment II.

Timbre and loudness repeated measures. Children's identification of melodic motion was significantly better when both tones of an interval were Timbre 1--a waveform strong in upper harmonics ($\bar{X}$ = .69). When the initial tone of an interval was Timbre 2--a waveform deficient in upper harmonics--and the second tone was Timbre 1, performance dropped significantly ($\bar{X}$ = .66), F (1, 60) = 26.78, $p<.0001$. There was no difference in identification ability as a function of the loudness level of the initial tone of an interval, 92 dBA ($\bar{X}$ = .66) and 82 dBA ($\bar{X}$ = .66), nor was there a significant interaction between the variables of timbre and loudness, Fs (1, 60)<1.0. There was a significant Timbre X Loudness X Task interaction, F (1, 54) = 20.84, $p<.0001$.

Interval type repeated measure. The main effect of interval type with seven levels (descending perfect fourth, minor third, and minor second, unison, and ascending minor second, minor third, and perfect fourth) was significant, F (4, 216) = 49.1, $p<.0001$. Interactions were found between the effect of interval type and the variables of timbre, F (3, 174) = 27.02, $p<.0001$, and loudness, F (3, 154) = 4.96, $p<.02$. The second-order interaction, Interval type X Timbre X Loudness, was significant, F (2, 141) = 4.54, $p<.01$. Between-group variables of grade and task did not affect the second-order interaction.

Post-hoc analyses were conducted using Scheffe Tests for Multiple Comparisons ($\alpha = .05$). The W-curve previously established as a base line with timbre and loudness constant is shown in Figure 4. Figure 4 further shows the effect of changing the timbre of the initial tone of an interval on this W-curve when loudness of both tones remained constant at 92 dBA.

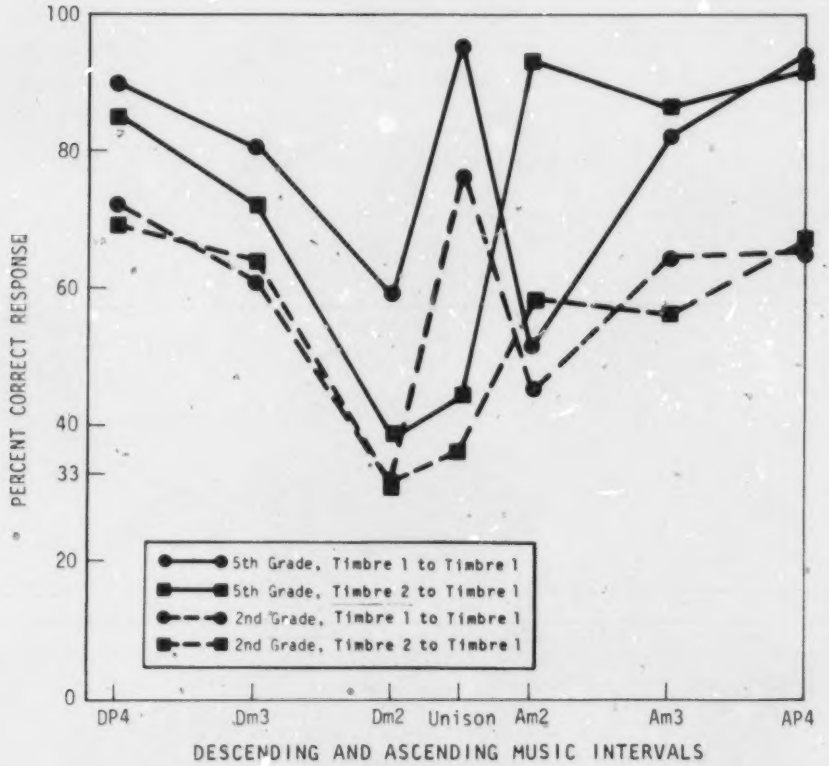

Figure 4. Performance on the interval type by timbre by loudness interaction when loudness is constant at 92 dBA.

At both grades, a change in timbre significantly reduced identification of melodic motion on the unison interval, and significantly increased identification of motion on the smallest ascending interval, the minor second. The change in timbre significantly lowered performance on the descending minor second.

Figure 5 shows the effect of changing the timbre of the initial tone of an interval on the base line W-curve when the loudness of the initial tone is attenuated to 82 dBA and the loudness of the second tone remains at 92 dBA. By comparing Figures 4 and 5, it can be seen that for both grades, change in loudness alone significantly lowers performance with the unison. The effect, however, is less than that produced by a change in timbre. Loudness change alone significantly increases fifth grade performance on the ascending minor second, but not second grade performance. Performance with the descending minor second is not significantly affected by loudness change. The simultaneous change of both timbre and loudness of the initial tone does not significantly increase the singular effect of timbre change when loudness is constant across the two tones of an interval. All observable differences in Figures 4 and 5, on the intervals larger than a minor second, were not statistically significant.

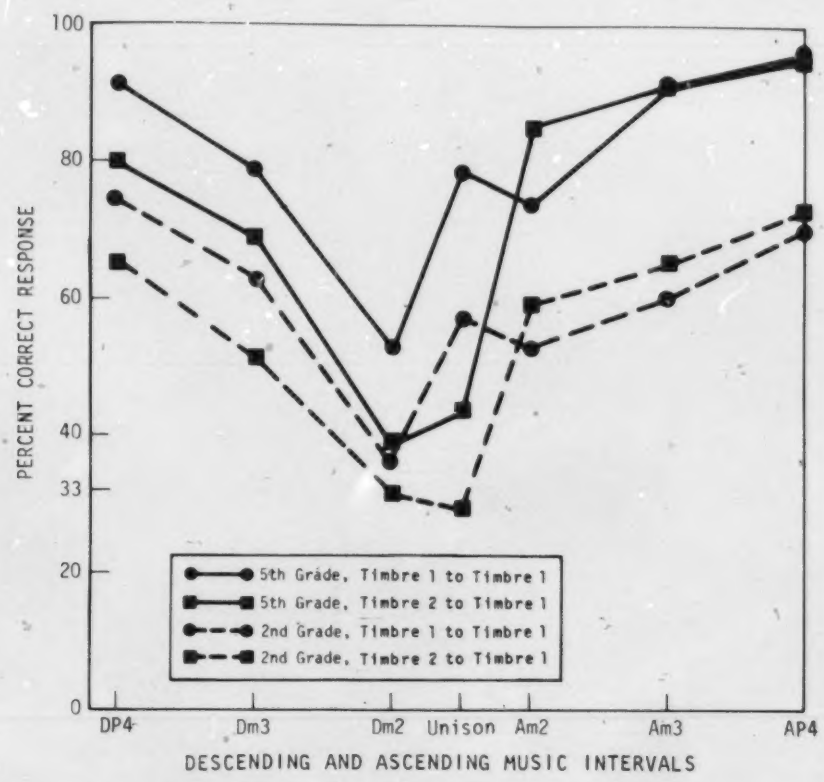

Figure 5. Performance on the interval type by timbre by loudness interaction when loudness is 82 and 92 dBA for the first and second tones respectively.

Analysis of errors in performance. Table 1 shows the proportion of children's responses for all three response categories for each timbre and loudness condition. Examination of these data reveal three trends that are maintained across grade. First, as predicted, when timbre and loudness were constant for the minor second motion, the most frequent errors were "straignt across" responses. Second, the effect of a change in either timbre or loudness of the initial tone resulted most frequently in an "up" response. When the change coincided with an ascending, minor second motion, performance was improved. When the change coincided with a descending, minor second motion, there was a decrement in performance and errors were most frequently "up" responses. Third, children had little difficulty identifying "straight across" motion when timbre and loudness were constant. A change in either parameter, however, resulted most frequently in "up" errors. Figure 6 graphically illustrates the effect on timbre shift on the response to small interval types.

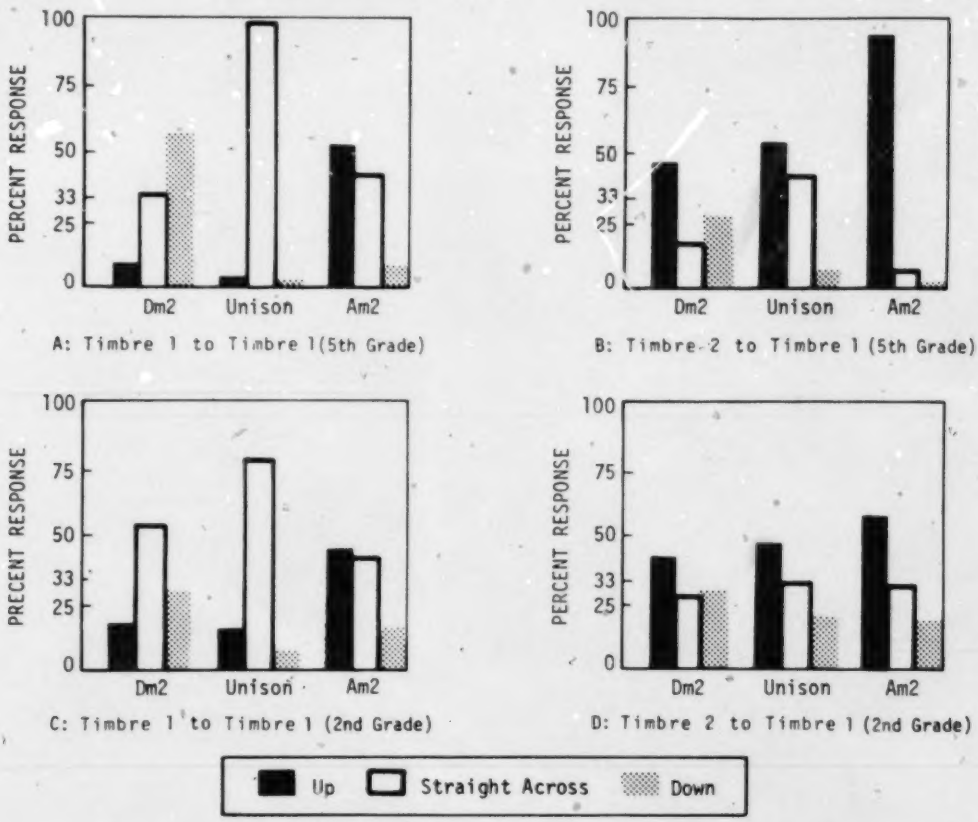

Figure 6. Histograms showing an analysis of all second- and fifth-grade responses for items in Experiment II where timbre was held constant for the two tones of the interval (Figures 6a and 6c), and for items where timbre was varied for the two tones of the interval (Figures 6b and 6d).

Table 1

Mean Number of Responses on Minor Second and Unison Intervals for Combinations of Timbre and Loudness

Timbre and Loudness of Initial Tone[a]	Response: Up	Response: Straight Across	Response: Down
Second Grade			
Timbre 1, 92 dBA			
Minor 2nd Ascending	.45	.41	.15
Unison	.15	.78	.06
Minor 2nd Descending	.17	.53	.30
Timbre 1, 82 dBA			
Minor 2nd Ascending	.53	.32	.15
Unison	.32	.58	.11
Minor 2nd Descending	.40	.25	.35
Timbre 2, 92 dBA			
Minor 2nd Ascending	.58	.23	.19
Unison	.48	.32	.20
Minor 2nd Descending	.42	.28	.30
Timbre 2, 82 dBA			
Minor 2nd Ascending	.58	.27	.15
Unison	.47	.27	.25
Minor 2nd Descending	.38	.31	.31
Fifth Grade			
Timbre 1, 92 dBA			
Minor 2nd Ascending	.51	.41	.08
Unison	.02	.97	.01
Minor 2nd Descending	.08	.34	.57
Timbre 1, 82 dBA			
Minor 2nd Ascending	.75	.20	.05
Unison	.15	.81	.52
Minor 2nd Descending	.30	.18	.52
Timbre 2, 92 dBA			
Minor 2nd Ascending	.93	.06	.01
Unison	.53	.42	.05
Minor 2nd Descending	.47	.16	.38
Timbre 2, 82 dBA			
Minor 2nd Ascending	.86	.09	.04
Unison	.49	.44	.07
Minor 2nd Descending	.49	.14	.38

[a]The second tone was constant at Timbre 1, 92 dBA

Analysis of the performance of fifth-graders with instrumental music training. An analysis of variance was computed on the fifth-grade data to examine the performance of those 15 children who had one or more years experience playing a musical instrument. The instrumental experience main effect was nonsignificant, $F(1, 28) = 1.43$, $p<.24$, but the Task X Instrument interaction was significant, $F(1, 28) = 4.94$, $p<.035$. As in the previous analysis, the Timbre X Loudness X Interval interaction was significant, $F(6, 168)$, 5.0, $p<.0001$. Figure 4 shows the effects of task and instrumental experience across the W-curve for interval size with timbre and loudness constant. Performance on the varied task was lowest for those fifth-graders with no instrumental experience. An examination of response errors across timbre and loudness variation revealed trends in performance similar to that of fifth graders with no instrumental training. Figure 7 shows the effect of instrumental experience on performance for the fixed- and varied-task across interval types.

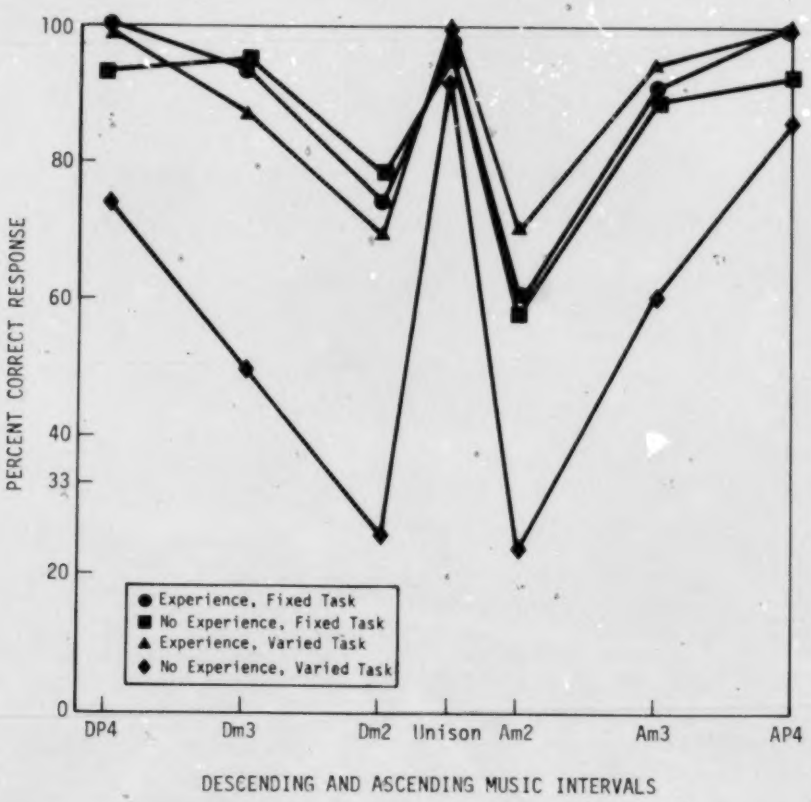

Figure 7. The effect of instrumental music experience on fifth-grade performance in Experiment II with the two experimental tasks across interval type. Timber and loudness are held constant.

Discussion

The purpose of Experiment II was to determine the effects of interval size and variations in timbre and loudness on children's perception of melodic interval motion. The data from the stimulus items where timbre and loudness were constant demonstrated that the size of the melodic interval was a significant factor in children's ability to identify the motion of a melodic interval. Performance for the minor second motion was an average 38 percent below performance for the perfect fourth motion. The analysis of response errors for the constant items indicated that when children misperceive small differences in pitch, they most frequently indicate the melodic motion as moving to the same pitch rather than using the opposite direction (i.e., same for up instead of down for up). These data confirm and extend the previous research of Bentley (1966), Duell and Anderson (1967), and Williams (Note 1).

Melodic intervals for the study were generated within the average child's singing range; direction of melodic motion appeared to have little effect on performance. This outcome suggests that the low ascending motion performance found in Bentley (1973) and Duell and Anderson (1967) may have been due to placing the intervals in the upper limits of the singing range.

Fifth-grade children performed the melodic motion identification task better than second-grade children, but size remained a determining factor. This confirms the findings of Bentley (1966), and parallels the longitudinal results of Petzold (1966) who found that a difference of three elementary grades produced improved perception of melodic patterns.

It was predicted that the varied experimental task, where the initial tone randomly varied within a set of five tones, would be more difficult than the fixed task, where the initial tone remained the same pitch. It was also suggested that the varied task better represented the perception of motion over successive tones in a melody because the nature of the task increases the need for processing each tone in the interval. Performance at both grades in this experiment was found to be lower for the varied task. However, with as little as one year of instrumental music training, fifth-grade performance on the varied task was comparable to performance on the fixed task.

With time events held constant across trials for each child, no differences were found as a result of long or short initial-tone and intertone times. These data do not support the results of Experiment I, nor the previous findings of this author (Williams, Note 1) which showed better performance on long intertone times with younger children. The effect on performance in Experiment I of a 1500-msec initial tone may have been reduced after children had been trained, or by the second or third sessions of the study children may have established workable strategies for coping with their assigned timing constraints.

Performance in Experiment I, and on the items in Experiment II where timbre and loudness were held constant, support the assumption that children in this study had established a perceptual set for pitch as the relevant dimension in identifying melodic motion. It was shown, however, that on the smallest interval, the minor second, perception of motion was easily affected by changes in other parameters of sound. A change of either 10 dBA in loudness or a shift in the upper harmonics of timbre resulted in distracting or biasing perceptual focus on pitch. Thus, as differences in the pitch dimension become perceptibly smaller, large changes in dimensions of sound irrelevant to the task appear to effect a greater influence on performance. Timbre appeared to have the greatest effect. This may have been due to a slight concomitant change in loudness as the harmonic energy increased with the change from Timbre 2 to Timbre 1 (see Footnote 1). A soft-to-loud change or a bland-to-rich change in timbre was perceived as an upward melodic motion. Hence, errors on unison motion increased and errors on ascending motion decreased. Further, the bias was so predominant that, when a timbre or loudness change coincided with a descending minor second, errors for downward motion increased and the motion was most often perceived as moving up.

The outcome from these data which was not predicted was the similar effect of timbre and loudness variation on perception of melodic motion at both grades. The selective attention research in verbal audition (e.g., Doyle, 1973; Maccoby & Konrad, 1966) suggests that fifth graders should have been less susceptible to variations in irrelevant dimensions of sound. Performance for second and fifth graders in Experiment II failed to show an increase in ability to selectively attend to the pitch dimension in the presence of competing information. Experience may best explain the discrepancy between a child's ability to selectively attend to speech as opposed to music information. Correct processing of the spoken word is constantly reinforced in child's learning environment; music processing of pitch is not.

Experiment III

This experiment examined the effect of the size of the first interval of a two-interval (three-pitch) pattern on children's performance on a melodic motion identification task. All tones moved in the same direction. The four between-group variables were also considered. Initial-tone and intertone times represented the duration of both the first and second tones (or intertone periods) of a melodic pattern. It was predicted that performance on the two-interval patterns would be superior to performance on those one-interval patterns in Experiment II where timbre and loudness were held constant, i.e., Timbre 1 at 92 dBA. Further, with two-intervals moving in the same direction, interval size should have little effect on performance.

The design was a split-plot with one repeated measure. The children were blocked by grade level and then randomly assigned to levels of the three remaining between-group factors. Thirty-two second-grade children were used for this experiment. Only 16 fifth-grade children were run; the task appeared to be too easy for them. The within-group, repeated measure was the interval type of the first interval in a two-interval melodic pattern (descending and ascending minor second, minor third, and perfect fourth, and the unison).

Stimuli. The stimuli consisted of 54 presentations of two-interval melodic patterns. Each pattern was made up of one of nine combinations of the three ascending and three descending intervals or, for the unison condition, three tones of the same pitch. Tones of the intervals were determined as in the other two experiments. In the fixed condition the first interval was derived from the Eb standard tone; in the varied condition the first interval was derived from one of five, randomly selected tones. Ordering of the stimulus presentation was randomized over two replications. Timbre and loudness were constant, Timbre 1 at 92 dBA. The third tone of a pattern was always 1000 msecs. However, depending upon the assigned between-group condition, the duration of the first and second tones and the duration of the first and second intertone silence was set to either 200 or 1500 msecs.

Procedures. Children were tested for this experiment two to three days after either Experiment I or II. The 54 stimuli were administered in one, 10-minute session. At the beginning of the session experimental procedures were reviewed and two practice trials were provided. The children were told that they would hear three tones instead of two. Just as before they were to "listen to how the pitch of the music moves."

Results

The number of correct responses in Experiment III were computed for each child as the average correct for two replications of each unique two-interval pattern. As in the prior experiments, data were scaled from 0 to 3.14. The data are recorded in Appendix C. Preliminary analysis revealed no differences for the between-group variables of initial-tone time, intertone time, and task, nor did these variables interact with others. The data were collapsed over these factors. The 27 items from Experiment II with timbre and loudness held constant were used in comparing the interval type results from the two experiments.

A 2 (experiments) X 2 (grade) X 7 (first interval) analysis of variance was conducted with the last factor a repeated measure for the interval type of the first interval of a melodic pattern. Degrees of freedom for F tests of the repeated measure were adjusted by epsilon.

Children's identification of melodic motion significantly improved when two intervals moving in the same direction defined melodic motion ($\bar{X}$ = .80) rather than one interval ($\bar{X}$ = .67), F (1, 92) = 9.8, $p<.002$. There was a significant difference in performance as a function of grade, F (1, 92) = 32.78, $p<.0001$. The mean performance for second graders was .66; mean performance for fifth graders was .89. Performance improved comparably for both grades when two-interval patterns were used (Grade X Experiments), F (1, 92)<1.0. The mean scores improved from .59 to .83 for the second graders and from 173 to .95 for the fifth graders.

The interval-type repeated measure was significant, F (5, 431) = 15.75, $p<.0001$. A W-curve in performance across interval type was obtained, though greatly elevated from performance in Experiment II. Performance across interval size was comparable for both grade levels (Interval type X Grade), F (5, 431) = 1.65, $p<.14$. Improvement in melodic motion identification between one- and two-interval patterns was shown to be a function of interval type (Interval type X Experiment), F (5, 431)= 7.14, $p<.0001$. The Interval type X Experiment X Grade interaction was nonsignificant, F (5, 431) = 1.58, $p<.32$).

Figure 4 shows the characteristic W-curve in performance across interval type by grade for Experiments II and III. Notable is the significant overall increase in ability to identify melodic motion as a result of two intervals defining melodic motion. Post-hoc Scheffe tests (α = .05) on the Interval type X Experiment interaction identified the greatest improvement occurring with performance on the minor second intervals, Fs (5, 431) = 9.17, $p<.01$. The only other significant improvement occurred with the descending minor third, F (5, 431) = 3.20, $p<.01$.

Discussion

As predicted, children's ability to identify melodic motion increased as a result of sounding two melodic intervals in succession instead of one interval. Performance, at least for second graders, remained a function of interval size. These date corroborate the earlier investigation of Williams et al. (1932). Performance on the smallest interval, the minor second, showed the greatest improvement. To a lesser extent, performance on the descending minor third improved significantly. The lack of a parallel increase for the ascending minor third appears to have been the result of an observable lower performance on the ascending, minor third for the second graders (see Figure 4). An effect similar to that in Bentley (1973) and Duell and Anderson (1967) may have been acting to reduce performance on the larger ascending patterns. With two minor thirds or perfect fourth intervals in succession, the last tone would sound in the upper extremities of a child's estimated singing range. The absence of this effect with the larger descending patterns cannot be explained.

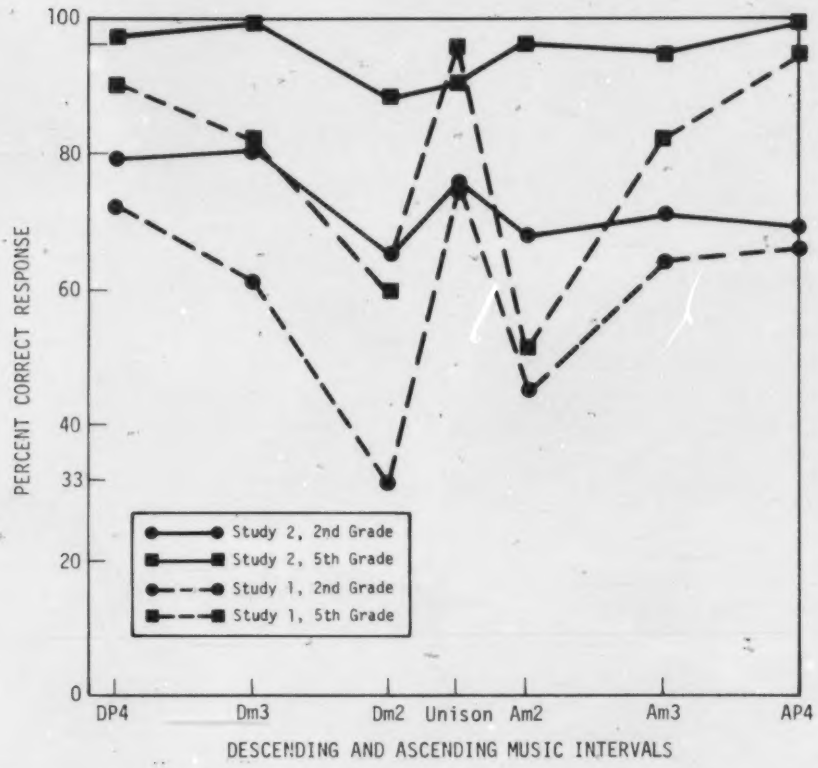

Figure 8. Second- and fifth-grade performance for one- and two-interval melodic patterns across interval type.

GENERAL DISCUSSION

This series of experiments with second- and fifth-grade children confirms and extends the research of Bentley (1966), Duell and Anderson (1967), and Williams (Note 1). The research clearly shows that children's ability to identify the motion of melodic intervals is determined by the size of the melodic interval. The smaller the interval, the greater the number of errors in performance. On unison intervals, performance equals that of large interval response. An analysis of the response errors for items where only the pitch dimension varied demonstrates that when children fail to recognize small descending or ascending interval motion, they perceive no difference in pitch. An ascending minor second was most frequently heard as a unison. The present investigation has also shown that the addition of a second melodic interval moving in the same direction will significantly increase melodic motion identification to a point where interval size is almost eliminated as a determining variable.

In the present research, intervals were sounded within a child's estimated singing range. In Experiments I and II no difference in performance was noted as a function of interval direction. Only in Experiment III was there as observable lower performance on the larger ascending, two-interval patterns. This suggests that the directional differences in Bentley (1973) and Duell and Anderson (1967) may have been due to the position of intervals with respect to a child's singing range. Recent research by Idson and Massaro (1967) with musically naive adults offers an alternative hypothesis. Musical tones may be processed and stored on the basis of octave differentiation. It may be that children transpose higher tones down an octave to place the tone within some octave bandwidth, hence the encoded direction of the stimulus has been reversed.

The present series of experiments tested the hypothesis that children's perceptual focus on pitch would be biased by changes in irrelevant dimensions of sound, namely timbre and loudness. The data clearly showed that as changes in the pitch dimension become smaller (i.e., minor second) children's attention can be distracted by competing changes in the loudness or timbre dimensions. A soft-to-loud change or a bland-to-rich change in timbre was most frequently perceived as an ascending pitch motion. This effect was so dominant that in the presence of competing changes in loudness or timbre, a descending minor second was perceived as an upward motion. Further research should vary loudness and timbre changes over small gradations to define the point at which differences in these dimensions no longer affect small pitch changes. In contrast to the results of verbal auditory research with children's selective attention (e.g., Doyle, 1975), it was found that the melodic perception of fifth grade children is as susceptible as that of second grade children to changes in irrelevant dimensions of sound.

The above outcomes of this research appeared robust to variations in the between-group variables of grade, task, and initial-tone and intertone time. For the most part these variables did not interact with

the within-group effects of interval size, timbre, and loudness. Increased experience (i.e., grade or music training) elevated performance, but interval size still determined response. Increased difficulty of the task (i.e., fixed to varied) lowered performance only in Experiment II where the melodic identification items were the most difficult. Interval size remained a determinant of response, though with the fifth graders, a marked difference was shown on the varied task between children with and without instrumental experience.

Except in the Experiment I training, variations in the duration of melodic events did not affect melodic events did not affect melodic motion identification. It appears that when time effects are held constant, children can adopt strategies to cope with duration as short as 200 msecs. The real time situation, when a child has to process a series of intervals in a melody with certain expectancies for time variation, would seem to lie somewhere between the conditions in this study where time events were constant, and the conditions of the previous research (Williams, Note 1) where time events constantly varied.

Implications for music instruction

The results of the present series of research and the related results of previous research on perception of melodic motion provide a basis for making some implications for teaching melodic motion to children. First, experience has been shown to be a determining factor. Kindergarten and first-grade children seem to encounter considerable difficulty with melodic motion identification (Duell & Anderson, 1967; Williams, Note.). There are labeling and other contributing factors at this age that have yet to be researched. The data indicate that second graders can perform the task but with limited success. Fifth grade children will be significantly better than second graders. However, even fifth graders may find identifying minor second melodic motion to be difficult. There is some evidence to suggest that children with specific instruction on a musical instrument will be more adept at recognizing melodic motion. Second, interval size, loudness, timbre, range, and rhythm have been shown to be determining factors. When focusing instruction on melodic motion, melodic patterns appear to be easiest when they are selected from within the singing range of the child (about A220 to C523). The motion of melodic intervals between a minor third and a major sixth is easier for children to perceive than minor second motion, or the motion of larger intervals. In beginning to illustrate single-direction melodic motion, two-interval patterns seem to greatly enhance identification, especially with the minor second interval. The loudness and timbre of each tone should be as uniform as possible.

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Appendix A

Data by Subjects (N = 64) for
Experiment I

Experiment I Data
Mean Responses for Descending Intervals and the Unison

	GROUPING VARIABLES				INTERVAL TYPE				
CASE-N	GRADE	TASK	TIME1	TIME2	DM7	DM6	DP5	DP4	UNIS
1	2.	1.	200.	200.	1.91	1.91	1.23	1.23	2.09
2	2.	1.	200.	200.	3.14	3.14	1.23	1.23	1.57
3	2.	1.	200.	200.	3.14	1.91	3.14	1.23	2.56
4	2.	1.	200.	200.	1.91	1.23	1.91	1.23	1.91
5	2.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14
6	2.	1.	200.	1500.	3.14	1.91	1.91	3.14	1.74
7	2.	1.	200.	1500.	1.23	1.91	1.23	1.91	1.05
8	2.	1.	200.	1500.	1.91	3.14	1.91	1.23	1.05
9	2.	1.	1500.	200.	3.14	3.14	3.14	1.91	2.56
10	2.	1.	1500.	200.	3.14	3.14	3.14	3.14	0.84
11	2.	1.	1500.	200.	1.91	1.91	3.14	3.14	3.14
12	2.	1.	1500.	200.	3.14	3.14	1.91	1.23	1.05
13	2.	1.	1500.	1500.	3.14	3.14	3.14	1.91	2.30
14	2.	1.	1500.	1500.	1.91	1.91	1.91	1.91	2.30
15	2.	1.	1500.	1500.	3.14	1.23	3.14	1.91	1.05
16	2.	1.	1500.	1500.	1.91	0.0	0.0	3.14	3.14
17	2.	2.	200.	200.	3.14	1.91	3.14	1.91	1.57
18	2.	2.	200.	200.	1.91	3.14	1.91	1.91	1.40
19	2.	2.	200.	200.	1.91	3.14	3.14	1.91	1.91
20	2.	2.	200.	200.	0.0	0.0	1.23	1.23	0.0
21	2.	2.	200.	1500.	3.14	1.91	1.23	1.23	1.91
22	2.	2.	200.	1500.	3.14	1.91	0.0	1.91	1.23
23	2.	2.	200.	1500.	3.14	1.91	1.91	1.23	1.74
24	2.	2.	200.	1500.	1.91	1.23	1.91	1.23	1.57
25	2.	2.	1500.	200.	3.14	3.14	3.14	1.91	3.14
26	2.	2.	1500.	200.	1.23	3.14	1.91	1.23	2.56
27	2.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
28	2.	2.	1500.	200.	1.23	1.23	1.23	3.14	1.74
29	2.	2.	1500.	1500.	3.14	3.14	1.91	3.14	2.30
30	2.	2.	1500.	1500.	3.14	3.14	1.91	1.23	2.56
31	2.	2.	1500.	1500.	1.23	3.14	1.91	1.91	2.30
32	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14	2.56
33	5.	1.	200.	200.	3.14	3.14	3.14	1.91	2.56
34	5.	1.	200.	200.	3.14	3.14	3.14	1.91	3.14
35	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14
36	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14
37	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14
38	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14
39	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	2.30
40	5.	1.	200.	1500.	3.14	1.91	1.91	1.23	3.14
41	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	2.56
42	5.	1.	1500.	200.	1.91	1.91	1.91	3.14	3.14
43	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14
44	5.	1.	1500.	200.	1.91	0.0	3.14	1.91	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14

Experiment I Data
Mean Responses for Descending Intervals and the Unison
(continued)

	GROUPING VARIABLES				INTERVAL TYPE				
CASE-N	GRADE	TASK	TIME1	TIME2	DM7	DM6	DP5	DP4	UNIS
48	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
49	5.	2.	200.	200.	1.23	3.14	1.23	1.91	2.56
50	5.	2.	200.	200.	1.91	3.14	3.14	3.14	3.14
51	5.	2.	200.	200.	3.14	3.14	1.91	3.14	3.14
52	5.	2.	200.	200.	1.91	3.14	1.91	0.0	1.74
53	5.	2.	200.	1500.	3.14	3.14	3.14	1.91	2.56
54	5.	2.	200.	1500.	0.0	1.91	0.0	3.14	1.40
55	5.	2.	200.	1500.	3.14	3.14	3.14	1.91	2.30
56	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	3.14
57	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
59	5.	2.	1500.	200.	1.91	1.91	1.91	1.23	2.56
60	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
61	5.	2.	1500.	1500.	1.91	3.14	3.14	1.91	3.14
62	5.	2.	1500.	1500.	3.14	3.14	3.14	1.91	3.14
63	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
64	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14	2.56

Note: Task(1) = Fixed, Task(2) = Varied; Time1 = Initial-Tone Duration, Time2 = Intertone Duration; For Interval Type: D = Descending, A = Ascending, Unis = Unison, M7 = Major Seventh, M6 = Major Sixth, P5 = Perfect Fifth, P4 = Perfect Fourth

Experiment I Data
Mean Responses for Ascending Intervals

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	AP4	AP5	AM6	AM7
1	2.	1.	200.	200.	1.91	1.23	3.14	1.91
2	2.	1.	200.	200.	1.91	1.91	0.0	1.91
3	2.	1.	200.	200.	1.23	1.91	1.91	3.14
4	2.	1.	200.	200.	1.23	3.14	1.23	1.23
5	2.	1.	200.	1500.	3.14	3.14	3.14	3.14
6	2.	1.	200.	1500.	1.23	1.91	1.23	1.91
7	2.	1.	200.	1500.	1.91	1.91	1.23	1.91
8	2.	1.	200.	1500.	1.91	3.14	1.91	1.23
9	2.	1.	1500.	200.	1.91	3.14	3.14	3.14
10	2.	1.	1500.	200.	1.91	1.91	0.0	1.91
11	2.	1.	1500.	200.	3.14	1.91	1.91	1.91
12	2.	1.	1500.	200.	1.23	0.0	0.0	1.23
13	2.	1.	1500.	1500.	3.14	3.14	1.91	1.91
14	2.	1.	1500.	1500.	1.91	1.23	1.91	1.91
15	2.	1.	1500.	1500.	1.23	1.91	3.14	1.23
16	2.	1.	1500.	1500.	1.91	1.91	1.23	1.91
17	2.	2.	200.	200.	1.91	1.23	1.91	1.91
18	2.	2.	200.	200.	1.91	1.91	1.23	3.14
19	2.	2.	200.	200.	1.23	3.14	3.14	3.14
20	2.	2.	200.	200.	1.23	1.91	1.23	0.0
21	2.	2.	200.	1500.	1.91	1.91	1.91	3.14
22	2.	2.	200.	1500.	1.23	1.23	1.91	1.91
23	2.	2.	200.	1500.	0.0	1.23	1.23	3.14
24	2.	2.	200.	1500.	1.23	1.23	1.23	1.91
25	2.	2.	1500.	200.	1.91	3.14	1.91	3.14
26	2.	2.	1500.	200.	1.23	1.23	3.14	1.91
27	2.	2.	1500.	200.	1.91	3.14	3.14	3.14
28	2.	2.	1500.	200.	0.0	3.14	1.91	1.91
29	2.	2.	1500.	1500.	1.23	1.91	3.14	3.14
30	2.	2.	1500.	1500.	1.91	1.91	0.0	1.91
31	2.	2.	1500.	1500.	1.23	0.0	3.14	1.23
32	2.	2.	1500.	1500.	1.91	3.14	1.91	3.14
33	5.	1.	200.	200.	1.91	3.14	3.14	3.14
34	5.	1.	200.	200.	1.91	3.14	3.14	3.14
35	5.	1.	200.	200.	1.23	3.14	3.14	3.14
36	5.	1.	200.	200.	3.14	3.14	3.14	3.14
37	5.	1.	200.	1500.	1.91	3.14	3.14	3.14
38	5.	1.	200.	1500.	3.14	3.14	3.14	3.14
39	5.	1.	200.	1500.	3.14	3.14	3.14	3.14
40	5.	1.	200.	1500.	1.91	3.14	3.14	3.14
41	5.	1.	1500.	200.	3.14	1.91	3.14	3.14
42	5.	1.	1500.	200.	1.91	3.14	1.91	1.91
43	5.	1.	1500.	200.	3.14	3.14	3.14	3.14
44	5.	1.	1500.	200.	1.23	1.23	1.23	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	1.91	3.14	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14

Experiment I Data
Mean Responses for Ascending Intervals
(continued)

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	AP4	AP5	AM6	AM7
48	5.	1.	1500.	1500.	1.91	3.14	3.14	3.14
49	5.	2.	200.	200.	3.14	1.91	1.91	3.14
50	5.	2.	200.	200.	1.91	3.14	3.14	3.14
51	5.	2.	200.	200.	1.91	1.91	3.14	3.14
52	5.	2.	200.	200.	1.23	1.23	1.23	1.23
53	5.	2.	200.	1500.	3.14	3.14	3.14	3.14
54	5.	2.	200.	1500.	1.23	3.14	1.23	1.91
55	5.	2.	200.	1500.	1.91	3.14	1.91	1.91
56	5.	2.	200.	1500.	3.14	3.14	3.14	3.14
57	5.	2.	1500.	200.	1.91	3.14	3.14	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	3.14
59	5.	2.	1500.	200.	1.23	3.14	1.91	3.14
60	5.	2.	1500.	200.	3.14	3.14	3.14	3.14
61	5.	2.	1500.	1500.	1.23	3.14	3.14	3.14
62	5.	2.	1500.	1500.	1.91	1.91	3.14	3.14
63	5.	2.	1500.	1500.	1.91	3.14	3.14	3.14
64	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14

Appendix B

Data by Subjects (N = 64) for
Experiment II

Experiment II Data
Mean Responses for 27 Items with Timbre 1 at 92 dBA Loudness

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4A	DM3A	DM2A	UNISA	AM2A	AM3A	AM4A
1	2.	1.	200.	200.	3.14	3.14	1.23	3.14	1.23	3.14	3.14
2	2.	1.	200.	200.	3.14	1.91	1.23	2.46	1.23	3.14	1.23
3	2.	1.	200.	200.	3.14	3.14	1.91	1.68	1.91	1.23	3.14
4	2.	1.	200.	200.	1.91	3.14	1.91	3.14	3.14	1.23	3.14
5	2.	1.	200.	1500.	1.91	1.91	1.91	2.46	1.91	1.23	3.14
6	2.	1.	200.	1500.	1.91	3.14	1.91	2.15	1.91	3.14	3.14
7	2.	1.	200.	1500.	3.14	3.14	1.23	3.14	1.91	1.91	3.14
8	2.	1.	200.	1500.	3.14	3.14	1.23	3.14	1.91	3.14	3.14
9	2.	1.	1500.	200.	3.14	1.91	1.23	2.16	1.91	1.23	1.91
10	2.	1.	1500.	200.	3.14	3.14	1.23	2.46	1.23	1.91	1.91
11	2.	1.	1500.	200.	1.23	1.91	0.0	3.14	0.0	1.91	1.91
12	2.	1.	1500.	200.	3.14	0.0	0.0	2.45	1.23	1.91	1.91
13	2.	1.	1500.	1500.	1.91	1.23	0.0	2.16	0.0	1.91	3.14
14	2.	1.	1500.	1500.	3.14	1.91	0.0	2.16	1.23	1.23	1.23
15	2.	1.	1500.	1500.	3.14	1.91	0.0	3.14	1.23	1.23	1.23
16	2.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
17	2.	2.	200.	200.	1.91	1.91	1.91	0.68	0.0	1.91	1.23
18	2.	2.	200.	200.	3.14	1.91	1.23	3.14	1.91	3.14	3.14
19	2.	2.	200.	200.	1.23	1.91	0.0	1.46	1.23	0.0	1.91
20	2.	2.	200.	200.	3.14	1.91	0.0	2.45	1.91	1.91	3.14
21	2.	2.	200.	1500.	3.14	1.23	1.23	2.46	1.23	3.14	3.14
22	2.	2.	200.	1500.	0.0	0.0	0.0	0.98	0.0	1.23	0.0
23	2.	2.	200.	1500.	1.91	1.91	1.91	2.45	3.14	1.23	1.91
24	2.	2.	200.	1500.	1.23	0.0	0.0	1.91	1.91	1.23	1.23
25	2.	2.	1500.	200.	3.14	1.23	0.0	3.14	0.0	3.14	3.14
26	2.	2.	1500.	200.	3.14	1.91	0.0	3.14	1.23	3.14	3.14
27	2.	2.	1500.	200.	0.0	1.91	1.23	1.23	3.14	1.23	0.0
28	2.	2.	1500.	200.	1.23	1.23	1.23	1.46	1.23	1.91	1.91
29	2.	2.	1500.	1500.	1.23	1.23	0.0	1.68	0.0	3.14	0.0
30	2.	2.	1500.	1500.	1.23	1.91	1.23	3.14	0.0	1.91	1.23
31	2.	2.	1500.	1500.	1.91	1.23	3.14	3.14	1.23	1.91	1.91
32	2.	2.	1500.	1500.	1.23	1.91	0.0	1.46	1.91	1.23	0.0
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14	1.91	3.14	3.14
35	5.	1.	200.	200.	3.14	3.14	3.14	3.14	0.0	3.14	3.14
36	5.	1.	200.	200.	1.23	3.14	1.23	2.46	1.23	0.0	1.23
37	5.	1.	200.	1500.	3.14	3.14	1.91	3.14	1.91	3.14	3.14
38	5.	1.	200.	1500.	3.14	1.91	1.23	3.14	1.91	3.14	3.14
39	5.	1.	200.	1500.	3.14	3.14	1.91	2.46	1.91	3.14	3.14
40	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	1.23	3.14	3.14
41	5.	1.	1500.	200.	3.14	3.14	1.23	3.14	1.91	3.14	3.14
42	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
43	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
44	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	1.91	3.14	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	3.14	1.23	3.14	0.0	3.14	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14

Experiment II Data
Mean Responses for 27 Items with Timbre 1 at 92 dBA Loudness
(continued)

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4A	DM3A	DM2A	UNISA	AM2A	AM3A	AP4A
48	5.	1.	1500.	1500.	3.14	1.91	1.23	2.46	0.0	1.91	3.14
49	5.	2.	200.	200.	3.14	1.91	0.0	3.14	1.23	1.91	3.14
50	5.	2.	200.	200.	3.14	1.91	1.23	3.14	1.91	3.14	3.14
51	5.	2.	200.	200.	3.14	1.91	1.23	3.14	1.23	3.14	3.14
52	5.	2.	200.	200.	3.14	1.91	1.23	3.14	1.91	3.14	3.14
53	5.	2.	200.	1500.	1.91	0.0	1.23	3.14	0.0	3.14	3.14
54	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
55	5.	2.	200.	1500.	1.91	1.91	0.0	2.15	0.0	1.23	1.23
56	5.	2.	200.	1500.	1.91	1.91	1.23	3.14	1.91	1.91	3.14
57	5.	2.	1500.	200.	1.91	3.14	1.23	3.14	0.0	1.23	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
59	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
60	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
61	5.	2.	1500.	1500.	3.14	3.14	1.23	3.14	0.0	1.91	3.14
62	5.	2.	1500.	1500.	0.0	0.0	0.0	1.68	0.0	0.0	1.91
63	5.	2.	1500.	1500.	3.14	1.91	0.0	3.14	0.0	1.91	1.91
64	5.	2.	1500.	1500.	3.14	1.23	0.0	3.14	0.0	1.23	3.14

Note: Task(1) = Fixed, Task(2) = Varied; Time1 = Initial-Tone Duration, Time2 = Intertone Duration; For Interval Type: D = Descending, A = Ascending, P4 = Perfect Fourth, M3 = Minor Third, M2 = Minor Second, Unis = Unison

Experiment II Data
Mean Responses for 27 Items with Timbre 1 at 82 dBA Loudness

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP48	DM38	DM28	UNIS8	AM28	AM38	AP48
1	2.	1.	200.	200.	3.14	1.91	1.91	2.16	1.91	1.91	1.91
2	2.	1.	200.	200.	1.91	0.0	0.0	1.91	3.14	0.0	1.91
3	2.	1.	200.	200.	3.14	3.14	0.0	1.23	0.0	1.23	3.14
4	2.	1.	200.	200.	1.91	3.14	1.91	1.23	0.0	0.0	3.14
5	2.	1.	200.	1500.	1.91	1.23	0.0	0.98	1.91	0.0	1.91
6	2.	1.	200.	1500.	3.14	1.91	0.0	1.68	0.0	1.91	1.91
7	2.	1.	200.	1500.	3.14	3.14	1.91	1.91	0.0	1.91	3.14
8	2.	1.	200.	1500.	3.14	1.91	1.91	3.14	1.23	3.14	3.14
9	2.	1.	1500.	200.	3.14	3.14	1.91	1.46	1.91	1.23	1.91
10	2.	1.	1500.	200.	3.14	1.91	1.91	3.14	1.23	0.0	1.91
11	2.	1.	1500.	200.	3.14	1.23	1.23	1.23	1.91	1.91	0.0
12	2.	1.	1500.	200.	3.14	1.91	1.91	3.14	1.91	3.14	1.23
13	2.	1.	1500.	1500.	3.14	1.23	1.23	0.68	3.14	3.14	1.91
14	2.	1.	1500.	1500.	1.23	1.23	0.0	0.98	3.14	3.14	1.91
15	2.	1.	1500.	1500.	0.0	1.23	0.0	1.45	3.14	3.14	3.14
16	2.	1.	1500.	1500.	3.14	3.14	3.14	1.91	3.14	3.14	3.14
17	2.	2.	200.	200.	1.23	3.14	1.23	1.23	1.23	1.91	1.91
18	2.	2.	200.	200.	3.14	1.91	1.91	2.45	3.14	3.14	3.14
19	2.	2.	200.	200.	1.23	1.23	1.23	1.46	1.23	1.23	1.23
20	2.	2.	200.	200.	0.0	1.91	1.23	1.46	1.91	1.91	3.14
21	2.	2.	200.	1500.	3.14	1.91	1.23	2.46	1.91	3.14	3.14
22	2.	2.	200.	1500.	0.0	0.0	1.23	0.0	1.91	3.14	3.14
23	2.	2.	200.	1500.	3.14	1.91	1.23	2.45	3.14	1.23	3.14
24	2.	2.	200.	1500.	1.91	1.91	0.0	1.46	1.91	1.91	1.23
25	2.	2.	1500.	200.	3.14	1.91	0.0	3.14	0.0	3.14	3.14
26	2.	2.	1500.	200.	3.14	1.91	1.23	2.16	0.0	1.91	3.14
27	2.	2.	1500.	200.	3.14	3.14	1.23	0.98	1.91	0.0	1.23
28	2.	2.	1500.	200.	1.23	1.23	1.23	2.16	1.23	1.91	1.91
29	2.	2.	1500.	1500.	1.23	3.14	1.91	1.46	1.23	3.14	0.0
30	2.	2.	1500.	1500.	1.23	1.91	1.23	2.16	0.0	0.0	1.23
31	2.	2.	1500.	1500.	3.14	3.14	0.0	1.91	3.14	1.91	3.14
32	2.	2.	1500.	1500.	3.14	1.23	1.23	1.91	1.23	1.23	1.23
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14	1.91	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
35	5.	1.	200.	200.	3.14	3.14	3.14	3.14	1.91	3.14	3.14
36	5.	1.	200.	200.	1.23	1.23	0.0	1.91	1.91	1.91	3.14
37	5.	1.	200.	1500.	3.14	3.14	1.91	3.14	3.14	3.14	3.14
38	5.	1.	200.	1500.	1.91	3.14	0.0	1.23	1.23	3.14	3.14
39	5.	1.	200.	1500.	3.14	1.91	1.23	2.15	1.91	3.14	3.14
40	5.	1.	200.	1500.	3.14	3.14	1.91	3.14	1.91	1.91	3.14
41	5.	1.	1500.	200.	3.14	3.14	1.91	2.16	3.14	3.14	3.14
42	5.	1.	1500.	200.	3.14	3.14	3.14	2.45	3.14	3.14	3.14
43	5.	1.	1500.	200.	3.14	3.14	1.91	3.14	1.91	1.91	3.14
44	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	1.23	3.14	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	3.14	1.23	2.46	1.23	1.23	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14

Experiment II Data
Mean Responses for 27 Items with Timbre 1 at 82 dBA Loudness
(continued)

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4B	DM3B	DV2B	UNISB	AM2B	AM3B	AP4B
48	5.	1.	1500.	1500.	3.14	3.14	3.14	2.16	1.23	1.91	3.14
49	5.	2.	200.	200.	3.14	3.14	0.0	2.46	1.91	3.14	3.14
50	5.	2.	200.	200.	3.14	1.23	0.0	3.14	3.14	3.14	3.14
51	5.	2.	200.	200.	3.14	3.14	1.23	1.23	3.14	3.14	3.14
52	5.	2.	200.	200.	3.14	1.91	1.23	3.14	3.14	3.14	3.14
53	5.	2.	200.	1500.	1.23	1.23	0.0	1.23	3.14	3.14	3.14
54	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	1.23	3.14	3.14
55	5.	2.	200.	1500.	3.14	1.91	1.23	0.98	3.14	1.91	1.91
56	5.	2.	200.	1500.	3.14	3.14	1.23	1.91	1.91	3.14	3.14
57	5.	2.	1500.	200.	1.91	0.0	0.0	0.68	3.14	3.14	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
59	5.	2.	1500.	200.	3.14	1.91	3.14	2.45	1.91	3.14	3.14
60	5.	2.	1500.	200.	3.14	3.14	1.91	3.14	3.14	3.14	3.14
61	5.	2.	1500.	1500.	3.14	1.23	0.0	1.68	1.91	3.14	3.14
62	5.	2.	1500.	1500.	1.23	0.0	0.0	2.16	1.91	1.91	1.91
63	5.	2.	1500.	1500.	1.91	1.91	1.23	2.46	1.23	3.14	1.91
64	5.	2.	1500.	1500.	3.14	1.91	0.0	3.14	1.91	3.14	3.14

Experiment II Data
Mean Response for 27 Items with Timbre 2 at 92 dBA Loudness

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4C	DM3C	DM2C	UNISC	AM2C	AM3C	AP4C
1	2.	1.	200.	200.	3.14	3.14	1.91	0.0	3.14	3.14	3.14
2	2.	1.	200.	200.	1.91	0.0	1.23	0.68	1.23	0.0	1.91
3	2.	1.	200.	200.	3.14	3.14	1.91	1.23	1.91	1.91	1.91
4	2.	1.	200.	200.	3.14	1.91	1.91	0.68	1.91	1.91	3.14
5	2.	1.	200.	1500.	3.14	1.23	1.23	0.68	1.91	1.91	1.23
6	2.	1.	200.	1500.	1.91	3.14	1.23	0.98	1.91	1.91	1.91
7	2.	1.	200.	1500.	1.91	1.23	0.0	1.68	1.91	1.23	1.23
8	2.	1.	200.	1500.	3.14	3.14	0.0	3.14	3.14	3.14	3.14
9	2.	1.	1500.	200.	3.14	1.23	1.23	0.68	1.23	1.91	3.14
10	2.	1.	1500.	200.	3.14	1.23	1.23	3.14	1.23	3.14	3.14
11	2.	1.	1500.	200.	1.91	3.14	1.23	0.0	1.23	1.91	1.91
12	2.	1.	1500.	200.	1.23	1.23	1.23	0.0	1.91	1.91	0.0
13	2.	1.	1500.	1500.	0.0	1.23	1.23	0.68	1.23	1.91	1.91
14	2.	1.	1500.	1500.	1.91	1.23	0.0	1.23	1.23	1.91	3.14
15	2.	1.	1500.	1500.	1.91	1.23	0.0	0.0	3.14	1.91	3.14
16	2.	1.	1500.	1500.	3.14	3.14	0.0	0.0	3.14	3.14	3.14
17	2.	2.	200.	200.	1.23	1.23	0.0	1.46	1.91	1.91	1.23
18	2.	2.	200.	200.	1.91	1.91	0.0	0.68	3.14	3.14	3.14
19	2.	2.	200.	200.	1.23	1.91	1.23	1.46	1.23	1.23	0.0
20	2.	2.	200.	200.	3.14	1.91	1.91	0.98	1.91	1.23	3.14
21	2.	2.	200.	1500.	3.14	3.14	0.0	1.91	3.14	1.23	3.14
22	2.	2.	200.	1500.	0.0	1.23	0.0	0.68	3.14	3.14	1.91
23	2.	2.	200.	1500.	3.14	3.14	1.23	2.16	1.91	3.14	3.14
24	2.	2.	200.	1500.	1.23	1.23	1.91	1.46	1.23	1.23	1.23
25	2.	2.	1500.	200.	3.14	3.14	1.91	0.68	1.91	0.0	1.91
26	2.	2.	1500.	200.	3.14	3.14	0.0	1.46	1.91	1.91	1.91
27	2.	2.	1500.	200.	1.23	1.91	1.23	0.98	1.23	1.23	1.91
28	2.	2.	1500.	200.	1.91	0.0	0.0	2.16	0.0	0.0	1.23
29	2.	2.	1500.	1500.	1.91	3.14	1.23	1.68	0.0	0.0	1.91
30	2.	2.	1500.	1500.	1.91	1.23	1.91	0.68	1.23	1.91	1.91
31	2.	2.	1500.	1500.	1.23	3.14	1.23	1.23	1.91	1.91	1.91
32	2.	2.	1500.	1500.	1.91	1.91	1.91	1.23	1.23	0.0	0.0
33	5.	1.	200.	200.	3.14	3.14	1.91	2.16	3.14	1.91	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14	1.91	3.14	3.14
35	5.	1.	200.	200.	3.14	3.14	1.23	2.46	3.14	3.14	3.14
36	5.	1.	200.	200.	1.23	1.23	1.23	0.68	3.14	1.91	1.91
37	5.	1.	200.	1500.	3.14	3.14	1.23	0.0	3.14	3.14	3.14
38	5.	1.	200.	1500.	1.91	1.91	0.0	0.98	3.14	3.14	3.14
39	5.	1.	200.	1500.	3.14	1.23	0.0	0.0	3.14	3.14	3.14
40	5.	1.	200.	1500.	3.14	3.14	1.23	2.46	1.91	0.0	1.23
41	5.	1.	1500.	200.	3.14	3.14	1.91	2.45	3.14	3.14	3.14
42	5.	1.	1500.	200.	3.14	3.14	0.0	0.0	3.14	3.14	3.14
43	5.	1.	1500.	200.	1.91	1.23	0.0	3.14	1.23	1.91	3.14
44	5.	1.	1500.	200.	3.14	3.14	1.91	0.98	3.14	3.14	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	1.91	1.23	1.68	3.14	3.14	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14

Experiment II Data
Mean Response for 27 Items with Timbre 2 at 92 dBA Loudness
(continued)

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4C	DM3C	DM2C	UNISC	AM2C	AM3C	AP4C
48	5.	1.	1500.	1500.	3.14	1.91	1.91	0.0	3.14	1.91	3.14
49	5.	2.	200.	200.	3.14	3.14	1.23	0.98	3.14	3.14	1.91
50	5.	2.	200.	200.	3.14	1.91	1.23	0.68	3.14	3.14	3.14
51	5.	2.	200.	200.	3.14	1.23	1.23	0.98	3.14	3.14	3.14
52	5.	2.	200.	200.	3.14	3.14	1.23	0.68	3.14	3.14	3.14
53	5.	2.	200.	1500.	1.23	1.23	0.0	0.68	3.14	3.14	3.14
54	5.	2.	200.	1500.	3.14	3.14	1.91	1.23	3.14	3.14	3.14
55	5.	2.	200.	1500.	3.14	1.23	0.0	1.68	1.23	1.91	3.14
56	5.	2.	200.	1500.	3.14	3.14	0.0	1.46	3.14	3.14	1.91
57	5.	2.	1500.	200.	0.0	0.0	0.0	0.68	3.14	3.14	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	2.46	3.14	3.14	3.14
59	5.	2.	1500.	200.	1.91	1.91	1.23	1.23	3.14	3.14	3.14
60	5.	2.	1500.	200.	3.14	3.14	1.91	2.15	3.14	3.14	3.14
61	5.	2.	1500.	1500.	3.14	0.0	0.0	0.68	3.14	3.14	3.14
62	5.	2.	1500.	1500.	0.0	0.0	0.0	1.23	1.91	1.23	1.91
63	5.	2.	1500.	1500.	3.14	1.91	0.0	0.68	3.14	3.14	3.14
64	5.	2.	1500.	1500.	1.91	3.14	1.91	0.68	3.14	0.0	1.91

Experiment II Data
Mean Response for 27 Items with Timbre 2 at 82 dBA Loudness

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4D	DM3D	DM2D	UNISD	AM2D	AM3D	AP4D
1	2.	1.	200.	200.	3.14	3.14	3.14	0.0	1.23	3.14	3.14
2	2.	1.	200.	200.	1.91	0.0	1.23	0.0	0.0	1.91	1.91
3	2.	1.	200.	200.	3.14	1.91	1.91	1.46	1.23	3.14	3.14
4	2.	1.	200.	200.	1.91	1.91	3.14	0.0	1.91	0.0	1.91
5	2.	1.	200.	1500.	1.91	1.23	0.0	0.69	3.14	3.14	1.91
6	2.	1.	200.	1500.	3.14	1.91	1.91	0.98	1.23	1.91	1.23
7	2.	1.	200.	1500.	3.14	1.91	1.23	2.46	1.91	3.14	3.14
8	2.	1.	200.	1500.	3.14	3.14	0.0	3.14	3.14	3.14	3.14
9	2.	1.	1500.	200.	3.14	3.14	1.23	1.46	1.23	1.23	0.0
10	2.	1.	1500.	200.	1.91	1.91	1.91	3.14	1.91	3.14	1.91
11	2.	1.	1500.	200.	1.23	1.23	0.0	0.68	3.14	3.14	1.23
12	2.	1.	1500.	200.	1.91	1.91	1.91	0.0	1.91	1.91	1.23
13	2.	1.	1500.	1500.	3.14	1.91	0.0	0.0	3.14	3.14	3.14
14	2.	1.	1500.	1500.	1.91	1.23	0.0	0.0	1.91	1.91	3.14
15	2.	1.	1500.	1500.	0.0	0.0	0.0	0.0	3.14	3.14	3.14
16	2.	1.	1500.	1500.	3.14	3.14	0.0	0.0	3.14	3.14	3.14
17	2.	2.	200.	200.	1.91	1.91	0.0	0.98	1.23	1.91	1.91
18	2.	2.	200.	200.	1.23	1.23	0.0	0.68	3.14	3.14	3.14
19	2.	2.	200.	200.	1.23	1.91	0.0	1.46	1.23	0.0	3.14
20	2.	2.	200.	200.	1.91	1.91	1.23	0.68	1.91	1.23	3.14
21	2.	2.	200.	1500.	1.91	1.91	1.91	1.68	1.23	3.14	3.14
22	2.	2.	200.	1500.	0.0	0.0	0.0	0.0	3.14	3.14	3.14
23	2.	2.	200.	1500.	1.91	1.23	1.23	1.91	1.91	1.91	1.23
24	2.	2.	200.	1500.	1.91	1.23	1.23	1.23	1.23	0.0	1.23
25	2.	2.	1500.	200.	3.14	3.14	1.91	0.68	1.23	1.23	3.14
26	2.	2.	1500.	200.	1.23	1.23	0.0	0.98	3.14	1.91	1.91
27	2.	2.	1500.	200.	1.91	1.23	1.91	0.0	1.91	1.91	1.91
28	2.	2.	1500.	200.	1.23	1.23	0.0	2.45	0.0	0.0	1.23
29	2.	2.	1500.	1500.	1.91	0.0	0.0	0.68	1.23	0.0	1.91
30	2.	2.	1500.	1500.	1.23	1.23	1.91	0.0	1.23	1.91	3.14
31	2.	2.	1500.	1500.	3.14	0.0	1.23	0.0	1.91	3.14	3.14
32	2.	2.	1500.	1500.	1.91	1.91	1.23	2.16	0.0	0.0	0.0
33	5.	1.	200.	200.	3.14	3.14	3.14	2.46	1.91	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	1.23	3.14	3.14	3.14	1.91
35	5.	1.	200.	200.	3.14	3.14	3.14	2.16	1.91	3.14	3.14
36	5.	1.	200.	200.	0.0	1.23	0.0	0.68	1.91	3.14	3.14
37	5.	1.	200.	1500.	1.91	3.14	0.0	0.0	3.14	3.14	3.14
38	5.	1.	200.	1500.	1.23	1.23	0.0	1.46	3.14	3.14	3.14
39	5.	1.	200.	1500.	1.91	1.91	1.23	0.0	3.14	3.14	3.14
40	5.	1.	200.	1500.	3.14	3.14	1.91	2.16	1.23	1.91	3.14
41	5.	1.	1500.	200.	3.14	3.14	1.91	1.91	3.14	3.14	3.14
42	5.	1.	1500.	200.	3.14	3.14	1.23	0.0	3.14	3.14	3.14
43	5.	1.	1500.	200.	3.14	1.23	1.91	2.16	1.91	3.14	3.14
44	5.	1.	1500.	200.	3.14	3.14	1.91	2.45	1.91	3.14	3.14
45	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
46	5.	1.	1500.	1500.	3.14	3.14	0.0	2.16	3.14	3.14	3.14
47	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14	3.14

Experiment II Data
Mean Response for 27 Items with Timbre 2 at 82 dBA Loudness
(continued)

	GROUPING VARIABLES				INTERVAL TYPE						
CASE-N	GRADE	TASK	TIME1	TIME2	DP4D	DM3D	DM2D	UNISD	AM2D	AM3D	AP4D
48	5.	1.	1500.	1500.	3.14	3.14	3.14	0.0	1.91	1.91	3.14
49	5.	2.	200.	200.	3.14	1.91	0.0	0.68	3.14	3.14	3.14
50	5.	2.	200.	200.	1.91	1.23	0.0	0.0	3.14	3.14	3.14
51	5.	2.	200.	200.	3.14	1.91	1.23	0.0	3.14	3.14	3.14
52	5.	2.	200.	200.	3.14	1.91	1.23	0.98	3.14	3.14	3.14
53	5.	2.	200.	1500.	0.0	1.23	0.0	0.0	3.14	3.14	3.14
54	5.	2.	200.	1500.	3.14	3.14	0.0	1.46	3.14	3.14	3.14
55	5.	2.	200.	1500.	3.14	1.91	1.23	1.46	1.91	1.23	1.91
56	5.	2.	200.	1500.	3.14	1.23	1.23	0.98	3.14	3.14	3.14
57	5.	2.	1500.	200.	0.0	0.0	0.0	0.0	3.14	3.14	3.14
58	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14	3.14
59	5.	2.	1500.	200.	3.14	1.23	0.0	0.98	1.91	3.14	3.14
60	5.	2.	1500.	200.	3.14	1.91	1.23	2.46	3.14	3.14	3.14
61	5.	2.	1500.	1500.	1.91	1.23	0.0	0.0	3.14	3.14	3.14
62	5.	2.	1500.	1500.	0.0	0.0	0.0	1.46	1.23	1.23	1.91
63	5.	2.	1500.	1500.	1.91	1.91	0.0	1.23	3.14	3.14	3.14
64	5.	2.	1500.	1500.	3.14	1.91	1.91	1.68	1.91	0.0	1.91

Appendix C

Data by Subjects (N = 48) for
Experiment III

Experiment III Data
Mean Responses for Two-Interval Patterns (DP4 + DP4 Through DM3 + DM2)

	GROUPING VARIABLES				INTERVAL TYPE					
CASE-N	GRADE	TASK	TIME1	TIME2	DP4DP4	DP4DM3	DP4DM2	DM3DP4	DM3DM3	DM3DM2
1	2.	1.	200.	200.	3.14	3.14	1.57	3.14	3.14	3.14
2	2.	1.	200.	200.	3.14	3.14	3.14	3.14	1.57	3.14
3	2.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
4	2.	1.	200.	200.	1.57	3.14	1.57	3.14	3.14	3.14
5	2.	1.	200.	1500.	3.14	3.14	3.14	1.57	3.14	3.14
6	2.	1.	200.	1500.	3.14	3.14	3.14	1.57	3.14	1.57
7	2.	1.	200.	1500.	1.57	3.14	1.57	1.57	1.57	0.0
8	2.	1.	200.	1500.	3.14	3.14	1.57	1.57	1.57	1.57
9	2.	1.	1500.	200.	3.14	3.14	3.14	1.57	3.14	3.14
10	2.	1.	1500.	200.	3.14	0.0	1.57	3.14	1.57	3.14
11	2.	1.	1500.	200.	3.14	1.57	3.14	3.14	3.14	0.0
12	2.	1.	1500.	200.	3.14	3.14	1.57	3.14	3.14	3.14
13	2.	1.	1500.	1500.	3.14	3.14	1.57	3.14	1.57	3.14
14	2.	1.	1500.	1500.	3.14	3.14	1.57	3.14	3.14	3.14
15	2.	1.	1500.	1500.	1.57	0.0	0.0	1.57	0.0	0.0
16	2.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
17	2.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
18	2.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
19	2.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
20	2.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
21	2.	2.	200.	1500.	3.14	3.14	1.57	3.14	1.57	3.14
22	2.	2.	200.	1500.	1.57	0.0	1.57	3.14	3.14	3.14
23	2.	2.	200.	1500.	3.14	1.57	0.0	1.57	1.57	3.14
24	2.	2.	200.	1500.	3.14	3.14	3.14	3.14	1.57	3.14
25	2.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14
26	2.	2.	1500.	200.	1.57	0.0	1.57	1.57	0.0	3.14
27	2.	2.	1500.	200.	1.57	1.57	0.0	0.0	3.14	1.57
28	2.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14
29	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
30	2.	2.	1500.	1500.	1.57	1.57	1.57	3.14	3.14	1.57
31	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
32	2.	2.	1500.	1500.	1.57	3.14	0.0	1.57	1.57	0.0
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
35	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
36	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
37	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	1.57	3.14
38	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14
39	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
40	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
41	5.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
42	5.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14	3.14
43	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
44	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	3.14	3.14
45	5.	2.	1500.	200.	3.14	3.14	0.0	3.14	3.14	3.14
46	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14	3.14
47	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (DP4 + DP4 Through DM3 + DM2) (continued)

	GROUPING VARIABLES				INTERVAL TYPE					
CASE-N	GRADE	TASK	TIME1	TIME2	DP4DP4	DP4DM3	DP4DM2	DM3DP4	DM3DM3	DM3DM2
48	5.	2.	1500.	1500.	3.14	3.14	1.57	3.14	3.14	3.14

Note: Task(1) = Fixed, Task(2) = Varied; Time1 = Initial Tone Duration, Time2 = Intertone Duration; For Interval Type: D = Descending, A = Ascending, Unis = Unison, P4 = Perfect Fourth, M3 = Minor Third, M2 = Minor Second

Experiment III Data
Mean Responses for Two-Interval Patterns (DM2 + DP4 Through UNIS + UNIS)

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	DM2DP4	DM2DM1	DM2DM2	UNIS
1	2.	1.	200.	200.	3.14	3.14	3.14	2.03
2	2.	1.	200.	200.	3.14	1.57	3.14	2.46
3	2.	1.	200.	200.	3.14	3.14	1.57	3.14
4	2.	1.	200.	200.	1.57	3.14	1.57	2.16
5	2.	1.	200.	1500.	3.14	1.57	1.57	2.30
6	2.	1.	200.	1500.	1.57	1.57	3.14	2.30
7	2.	1.	200.	1500.	3.14	3.14	0.0	1.46
8	2.	1.	200.	1500.	1.57	0.0	3.14	1.79
9	2.	1.	1500.	200.	3.14	3.14	3.14	3.14
10	2.	1.	1500.	200.	1.57	0.0	1.57	3.14
11	2.	1.	1500.	200.	1.57	1.57	1.57	2.67
12	2.	1.	1500.	200.	3.14	3.14	3.14	3.14
13	2.	1.	1500.	1500.	3.14	3.14	1.57	3.14
14	2.	1.	1500.	1500.	0.0	0.0	3.14	2.46
15	2.	1.	1500.	1500.	0.0	3.14	1.57	3.14
16	2.	1.	1500.	1500.	3.14	3.14	1.57	3.14
17	2.	2.	200.	200.	3.14	3.14	3.14	2.67
18	2.	2.	200.	200.	3.14	3.14	3.14	2.30
19	2.	2.	200.	200.	3.14	0.0	0.0	1.79
20	2.	2.	200.	200.	1.57	1.57	3.14	1.68
21	2.	2.	200.	1500.	3.14	0.0	0.0	1.79
22	2.	2.	200.	1500.	1.57	3.14	1.57	1.35
23	2.	2.	200.	1500.	1.57	0.0	0.0	1.68
24	2.	2.	200.	1500.	1.57	0.0	1.57	3.14
25	2.	2.	1500.	200.	3.14	1.57	3.14	3.14
26	2.	2.	1500.	200.	1.57	3.14	1.57	2.30
27	2.	2.	1500.	200.	0.0	0.0	0.0	2.67
28	2.	2.	1500.	200.	3.14	3.14	3.14	3.14
29	2.	2.	1500.	1500.	3.14	3.14	3.14	2.67
30	2.	2.	1500.	1500.	1.57	3.14	1.57	0.90
31	2.	2.	1500.	1500.	3.14	3.14	0.0	2.30
32	2.	2.	1500.	1500.	0.0	1.57	1.57	1.35
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14
35	5.	1.	200.	1500.	1.57	3.14	3.14	3.14
36	5.	1.	200.	1500.	3.14	3.14	3.14	2.67
37	5.	1.	1500.	200.	3.14	3.14	3.14	3.14
38	5.	1.	1500.	200.	3.14	3.14	3.14	3.14
39	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14
40	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14
41	5.	2.	200.	200.	1.57	1.57	3.14	2.03
42	5.	2.	200.	200.	3.14	3.14	3.14	3.14
43	5.	2.	200.	1500.	3.14	3.14	3.14	3.14
44	5.	2.	200.	1500.	3.14	1.57	0.0	1.57
45	5.	2.	1500.	200.	1.57	1.57	1.57	2.03
46	5.	2.	1500.	200.	3.14	3.14	3.14	2.67
47	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (DM2 + DP4 Through UNIS + UNIS)
(continued)

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	DM2DP4	DM2DM3	DM2DM2	UNIS
48	5.	2.	1500.	1500.	3.14	1.57	1.57	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (AM2 + AM2 Through AM3 + AM3)

	GROUPING VARIABLES				INTERVAL TYPE				
CASE-N	GRADE	TASK	TIME1	TIME2	AM2AM2	AM2AM3	AM2AM4	AM3AM2	AM3AM3
1	2.	1.	200.	200.	3.14	3.14	3.14	1.57	1.57
2	2.	1.	200.	200.	1.57	1.57	3.14	1.57	3.14
3	2.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14
4	2.	1.	200.	200.	3.14	0.0	1.57	1.57	0.0
5	2.	1.	200.	1500.	3.14	0.0	1.57	3.14	3.14
6	2.	1.	200.	1500.	1.57	3.14	3.14	3.14	3.14
7	2.	1.	200.	1500.	1.57	0.0	0.0	1.57	1.57
8	2.	1.	200.	1500.	1.57	3.14	1.57	1.57	3.14
9	2.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14
10	2.	1.	1500.	200.	3.14	0.0	3.14	0.0	3.14
11	2.	1.	1500.	200.	1.57	3.14	3.14	1.57	1.57
12	2.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14
13	2.	1.	1500.	1500.	0.0	3.14	3.14	0.0	3.14
14	2.	1.	1500.	1500.	1.57	3.14	3.14	3.14	3.14
15	2.	1.	1500.	1500.	1.57	1.57	3.14	3.14	0.0
16	2.	1.	1500.	1500.	1.57	3.14	3.14	3.14	1.57
17	2.	2.	200.	200.	0.0	3.14	3.14	3.14	3.14
18	2.	2.	200.	200.	3.14	3.14	3.14	1.57	3.14
19	2.	2.	200.	200.	0.0	3.14	3.14	1.57	1.57
20	2.	2.	200.	200.	1.57	3.14	3.14	1.57	1.57
21	2.	2.	200.	1500.	1.57	3.14	0.0	0.0	1.57
22	2.	2.	200.	1500.	1.57	1.57	0.0	1.57	1.57
23	2.	2.	200.	1500.	1.57	0.0	1.57	0.0	1.57
24	2.	2.	200.	1500.	1.57	1.57	3.14	3.14	3.14
25	2.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
26	2.	2.	1500.	200.	0.0	0.0	0.0	0.0	1.57
27	2.	2.	1500.	200.	3.14	3.14	0.0	1.57	3.14
28	2.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
29	2.	2.	1500.	1500.	0.0	3.14	3.14	1.57	3.14
30	2.	2.	1500.	1500.	0.0	1.57	1.57	3.14	1.57
31	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
32	2.	2.	1500.	1500.	1.57	0.0	0.0	1.57	0.0
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14	3.14
35	5.	1.	200.	1500.	3.14	3.14	3.14	3.14	3.14
36	5.	1.	200.	1500.	0.0	3.14	3.14	1.57	1.57
37	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14
38	5.	1.	1500.	200.	3.14	3.14	3.14	3.14	3.14
39	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
40	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14	3.14
41	5.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14
42	5.	2.	200.	200.	3.14	3.14	3.14	3.14	3.14
43	5.	2.	200.	1500.	3.14	3.14	3.14	3.14	3.14
44	5.	2.	200.	1500.	1.57	3.14	3.14	3.14	3.14
45	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	1.57
46	5.	2.	1500.	200.	3.14	3.14	3.14	3.14	3.14
47	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (AM2 + AM2 Through AM3 + AM3)
(continued)

	GROUPING VARIABLES				INTERVAL TYPE				
CASE-N	GRADE	TASK	TIME1	TIME2	AM2AM2	AM2AM3	AM2AP4	AM3AM2	AM3AM3
48	5.	2.	1500.	1500.	1.57	3.14	3.14	1.57	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (AM3 + AP4 Through AP4 + AP4)

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	AM3AP4	AP4AM2	AP4AM3	AP4AP4
1	2.	1.	200.	200.	3.14	1.57	3.14	3.14
2	2.	1.	200.	200.	3.14	1.57	3.14	3.14
3	2.	1.	200.	200.	3.14	3.14	3.14	3.14
4	2.	1.	200.	200.	0.0	3.14	0.0	0.0
5	2.	1.	200.	1500.	3.14	3.14	3.14	1.57
6	2.	1.	200.	1500.	3.14	1.57	3.14	1.57
7	2.	1.	200.	1500.	1.57	0.0	0.0	0.0
8	2.	1.	200.	1500.	1.57	1.57	3.14	1.57
9	2.	1.	1500.	200.	3.14	3.14	3.14	3.14
10	2.	1.	1500.	200.	3.14	1.57	3.14	3.14
11	2.	1.	1500.	200.	1.57	3.14	0.0	1.57
12	2.	1.	1500.	200.	3.14	3.14	3.14	3.14
13	2.	1.	1500.	1500.	3.14	3.14	3.14	3.14
14	2.	1.	1500.	1500.	3.14	3.14	3.14	3.14
15	2.	1.	1500.	1500.	3.14	0.0	0.0	1.57
16	2.	1.	1500.	1500.	3.14	3.14	3.14	3.14
17	2.	2.	200.	200.	3.14	3.14	3.14	3.14
18	2.	2.	200.	200.	3.14	3.14	3.14	3.14
19	2.	2.	200.	200.	3.14	0.0	3.14	3.14
20	2.	2.	200.	200.	0.0	1.57	3.14	1.57
21	2.	2.	200.	1500.	1.57	0.0	1.57	0.0
22	2.	2.	200.	1500.	0.0	3.14	3.14	0.0
23	2.	2.	200.	1500.	1.57	0.0	0.0	0.0
24	2.	2.	200.	1500.	3.14	1.57	3.14	3.14
25	2.	2.	1500.	200.	3.14	3.14	3.14	3.14
26	2.	2.	1500.	200.	1.57	0.0	0.0	0.0
27	2.	2.	1500.	200.	3.14	3.14	1.57	3.14
28	2.	2.	1500.	200.	3.14	3.14	3.14	3.14
29	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14
30	2.	2.	1500.	1500.	0.0	0.0	1.57	0.0
31	2.	2.	1500.	1500.	3.14	3.14	3.14	3.14
32	2.	2.	1500.	1500.	1.57	1.57	1.57	0.0
33	5.	1.	200.	200.	3.14	3.14	3.14	3.14
34	5.	1.	200.	200.	3.14	3.14	3.14	3.14
35	5.	1.	200.	1500.	3.14	3.14	3.14	3.14
36	5.	1.	200.	1500.	3.14	3.14	3.14	3.14
37	5.	1.	1500.	200.	3.14	3.14	3.14	3.14
38	5.	1.	1500.	200.	3.14	3.14	3.14	3.14
39	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14
40	5.	1.	1500.	1500.	3.14	3.14	3.14	3.14
41	5.	2.	200.	200.	1.57	3.14	3.14	3.14
42	5.	2.	200.	200.	3.14	3.14	3.14	1.57
43	5.	2.	200.	1500.	3.14	3.14	3.14	3.14
44	5.	2.	200.	1500.	3.14	3.14	3.14	3.14
45	5.	2.	1500.	200.	3.14	3.14	3.14	3.14
46	5.	2.	1500.	200.	3.14	3.14	3.14	3.14
47	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14

Experiment III Data
Mean Responses for Two-Interval Patterns (AM3 + AP4 Through AP4 + AP4)
(continued)

	GROUPING VARIABLES				INTERVAL TYPE			
CASE-N	GRADE	TASK	TIME1	TIME2	AM3AP4	AP4AM2	AP4AM3	AP4AP4
48	5.	2.	1500.	1500.	3.14	3.14	3.14	3.14